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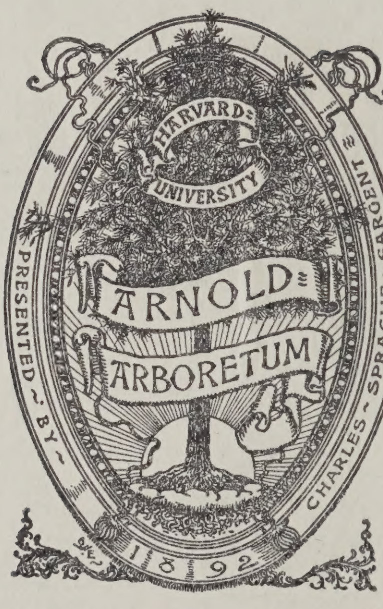

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VOLUME 4

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THE LINGNAAM AGRICULTURAL REVIEW

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WILLIAM E. HOFFMANN, M.A., Editor.

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THE LINGNAAM
AGRICULTURAL REVIEW

Volume IV March, 1927 Number 1

A CHINESE EARTHWORM

FOR LABORATORY WORK

PERICHAETA HUPEHENSIS MICHAELSON

N. GIST GEE, ALICE M. BORING, AND CHENFU F. WU

Peking, China.

External Features

Number of Segments.—The number of segments is variable and counts of a number of worms give a variation of from 60 to 117 segments. A study of a larger series of worms may give even a wider range of variation. The count of 37 worms gives an average of 98 segments. It is interesting to notice that Prof. Hatai gives a greater average number of segments, 118, for one of the common Japanese worms, *Perichaeta megascolidioides.*

Clitellum.—In adult worms, a band, the clitellum, is found near the anterior end of the body. Invariably this clitellum covers the 14th, 15th, and the 16th segments. It can be easily recognized by the fact that it is smooth and darker in color than the regular segment. Most of the regular segments each have a row of short bristles or setae entirely encircling them. The fact that there are 3 segments covered by the clitellum corresponds with what Hatai found in *P. megascolidioides* and differs from *P. philgendorfi* which has only 2 segments under the clitellum as described by Michaelson.

Male Genital Ducts.—On the ventral surface of the 18th segment are found a pair of genital papillae with openings at their tips. These are usually very evident after the worm has been killed by chloroform since they become extended. *P. megascolidioides* is the only perichaeta so far described which differs in this point and it has these papillae on the 19th segment.

Spermathecal Openings of the Sperm Sacs.—There are from two to four pairs of these in the common Soochow worm, though the normal number is three, and they occur on the ventral side between the 6th and 7th, 7th and 8th, and 8th and 9th segments. It is interesting to note that the Indian worm, *Pheretima posthuma,* differs from ours by having four pairs of spermathecae instead of three and that they open in similar locations with the first pair coming between the 5th and 6th segments; also that the Japanese worm has 5, the first pair of openings occurring between the 4th and 5th. On the ventral surface of segments 6 to 10 there may be found minute openings of accessory glands. These vary considerably both in number and in location. In the seventy-five worms so far examined it has been observed that these openings vary from complete absence to as many as seven pairs. They may occur singly or paired on the segments and as many as two pairs may be found on the same segment. At present an extended study of these glands is being made.

Female Genital Pore.—This is a single opening and always occurs in the median line on the ventral side on the front margin of the 14th segment, or the first clitellar segment. This is, of course, covered by the clitellar band but may be visible from the outside at times.

Dorsal Pores.—There are dorsal pores, one in each segment on the mid dorsal line beginning with the 13th segment. Those are the pores from which the milky fluid is excreted when the worm is chloroformed.

Setae, or Cuticular Bristles.—Every segment except the first, the last (sometimes the next to the last), and the clitellum band is completely encircled by a row of short, stiff bristles. The three segments covered by the clitellum also bear setae. The number of setae varies with the diameter of the worm, and increases in number from the first segment, for example as follows: 0, 25, 31, 33, 40, 43, 46, etc. The minimum number found on any segment was 5 and the maximum number was 62. An average number for the larger middle body segments was from 50 to 60. At the posterior end, the number gradually decreases, for example, on the last six segments of one worm, 44, 41, 40, 31, 8, 0.

Careful counts of the setae on segments from typical regions of the body of three worms of 105, 102, and 95 segments respectively have been made. The results are shown in the following table:

Segment Number	*Number of Setae*		
	Worm A.	Worm B.	Worm C.
1	0	0	0
2		18	18
3		20	21
6	46	38	45
7	48	37	52
8	48	39	52
9	49		54
13	31	26	
14	(Clitellar)		62
15	(Segments)		60
16	( )		52
17	23	25	62
38	48	48	
39	47	43	
40		42	
60	46	32	
61	47	33	
90		17	

Segment Number		*Number of Setae*	
	Worm A.	Worm B.	Worm C.
91		8	
92	31	0	
93	30	0	
103	12		
104	5		
105	0		

This shows gradual increase for the first nine segments, decrease just anterior and posterior to the clitellum, and gradual decrease at the posterior end of the body. It is of interest to note here that the Indian earthworm, *P. posthuma*, has a larger number of setae to the segment, the statement describing that worm saying that there were "a large number (about 100)." Prof. Hatai has published an accurate table of setae number for every body segment in 5 worms of varying body length. 92 is the average maximum number for these 5 worms of the species *P. megascolidioides*.

Anus.—The anus is a vertical slit on the last segment.

Internal Structure

Digestive System.—The mouth opens on the first or buccal segment and ventral to the prostomium or protrusible lip. The mouth leads into a thin walled *buccal cavity* extending almost to the 4th segment where it is separated from the pharynx by a constriction on the dorsal side. Immediately following this thin walled cavity is the thick walled *pharynx*. The pharynx extends to the 5th or 6th segment in some cases, though the dividing line between it and the gullet which follows it is somewhat difficult to define. *There are no septa in the region between segments from one to five. The buccal cavity is held in position by numerous, heavy, radially arranged muscles which attach it to the body wall.* The pharynx and gullet, or oesophagus, are narrower than the buccal cavity and they extend through one or two segments, a slight variation occurring here. They usually occupy the 6th or 7th segment. The crop follows the gullet and is generally found in the seventh segment though it may vary somewhat, at times. The crop is dilated at its posterior end and is followed by the gizzard after a decided constriction. Next the *gizzard* is found, a thick, round, muscular organ which occupies in most cases the 8th, 9th, and 10th segments. There are no septa between the 8th and 9th and the 9th and 10th segments. The *intestine* extends from the gizzard throughout the rest of the body. Leaving the gizzard the intestine is very small but gradually enlarges until it reaches its normal size in the region of the intestinal caeca. At about the 26th segment a pair of pouches, called *intestinal caeca* are given off and extend anteriorly through three or four segments. In the *Lumbricus* the dorsal wall of the intestine is folded downward so as to form a small but distinct longitudinal ridge or *typhosole*. This infolding of a portion of the wall increases the absorbing surface of the organ. In the *Perichaeta* the typhosole is present but is much smaller than in the *Lumbricus*.

Chromophil Cells.—There are two other features in connection with the worm which attract attention and which should be mentioned. The first is that the buccal cavity and the pharynx are both covered by a thick mass of grayish tissue in the fresh worm which pretty well fills up the open space in this portion of the body. This mass is made up of "peculiar irregularly-shaped, deeply-staining 'chromophil cells'" which are held together by the numerous, interlacing fibers of muscles which occur in this portion of the worm.

Chloragogen.—The other is that the surface of the intestine is covered by the *chloragogen* or *yellow cells*. These give a decided yellowish color to the intestine in the living worm and are supposed to exercise an excretory function.

Nervous System.—The *brain* of the worm consists of two pear shaped ganglia so closely fused that no line of division is apparent and it is always located on the dorsal side of the buccal sac in the 2nd segment. Two nerve cords extend down around the pharynx and unite in a ventral position in the 3rd segment forming a decided enlargement, the suboesophageal ganglion. From this ganglion the ventral nerve cord continues posteriorly throughout the length of the body of the worm. This *ventral nerve cord* shows in cross section that it is composed of two fused longitudinal cords covered by a common sheath. In a well preserved specimen, the two cords are visible within the common sheath.

The ventral cord is slightly enlarged into a ganglion in each segment and from this is sent out three pairs of nerves to supply that segment. A smaller pair of nerves is given at the middle of each segment while a larger pair is given off on the posterior margin of each segment.

A small species of *Lumbricus* also occurs in China and furnishes some interesting comparisons with the *Perichaeta*. In the *Perichaeta* the entire system, both ganglia and nerves, shows greater fusion. The cerebral ganglia, or brain, are fused into a continuous band instead of being like two separate ganglia. Upon a hurried examination it looked as though there were only two pairs of nerves to each segment, one large pair from the ganglia to the body wall, and one smaller pair from the connectives between ganglia to the septa. But the general survey made by the whole biology class at Yenching University reported sometimes two and sometimes three pairs of nerves to each segment. On closer study by the student to whom this problem was turned over it appeared that each large nerve was really made up of two components which are usually fused and in one sheath, but sometimes may remain separate. Often when fused, there is still a groove showing the line of division between the two component nerves. In *Lumbricus*, there are always two pairs from the ganglia, there are frequent long splits in the ventral cord and the two cerebral ganglia lie almost quite separate from each other.

Excretory System.—In the common western earthworm *(Lumbricus)* the excretory organs are little tubes called *nephridia,* and a pair of these are found in each segment, but in the *Perichaeta,* there are no such conspicuous nephridia. The excretory tubules in the Indian worm *(Pheretima)* have been described as very numerous and very fine and are located on the septa and the inner surfaces of the body wall. This is where the excretory organs have been found in the Chinese worm, *Perichaeta.* but this problem will need a further histological study, and this is now being undertaken.

Vascular System.—The earthworm has blood vessels and blood. There are three main vessels, (1) the large *dorsal* blood-vessel which lies above the intestine, (2) the smaller *ventral* blood-vessel which lies below the intestine, (3) the still smaller one, the *subneural* vessel, which lies between the large ventral nerve and body wall. All of these are connected with each other by paired vessels some of which are called "hearts" or aortic arches. There are four pairs of aortic arches occurring in the 10th, 11th, 12th, and 13th segments. The circulation is brought about by the peristaltic contraction of the larger vessels and the blood is kept moving through the system.

In the Soochow *Perichaeta* the ventral vessel is double at the anterior end, from the posterior edge of the gizzard forward.

While the blood is red, and the color is due to *haemoglobin* as in the higher animals, yet there are no corpuscles, but the color is dissolved in the plasma.

Reproductive System.—Each earthworm contains both ovaries and spermaries, however. it is not self fertilizing. The eggs of one are fertilized by the sperm from another worm. Copulation takes place by the contact of the ventral portions of the bodies of the worms with anterior ends pointing in opposite directions so that the male genital papillae of one worm will come in contact with the spermathecae of the other worm and vice versa.

We have already described the openings of the sex organs on the external surface of the worm. but now it remains to describe the internal location of these organs.

The *ovaries* are a pair of very small bodies (about 1 mm.) inside of the 13th segment and attached to the wall of the septum which divides 12th and 13th segments. The ovaries lie on a level with the upper portion of the intestine and the funnels lie immediately below them. From the funnels two oviducts lead downward toward the midventral line and unite beneath the ventral nerve cord and then this common oviduct opens to the outside through a single pore on the ventral side of the 14th segment.

The *spermathecae* or sperm receptacles receive the sperm from another worm and hold them until the clitellum, containing the eggs, passes anteriorly over that portion of the body and the sperm are then passed into clitellar band into contact with the eggs and the eggs are thus fertilized. Each pair of spermathecae lies in one segment and their openings are in the grooves separating the segments in which they are located from the one just anterior to it. Their location is given in the description of external characteristics.

The two pairs of large irregularly shaped *seminal vesicles* are readily found in the 11th and 12th segments. By carefully removing these large vesicles two pairs of small rounded spermaries can then be located near the midventral line on the inside of these two segments. From each of the four spermaries there proceeds backward one spermiduct, or vas deferens, to the ventral side of the 18th segment where it joins the *prostate gland.* The two spermiducts on the same side do not fuse together throughout their length.

The prostates or spermiducal glands are a pair of large, much-lobed glands. In these glands the sperm receive a mucous liquid and are then passed out through the male genital tubes in the 18th segment. These glands extend through several segments.

LABORATORY DIRECTIONS

CHINESE EARTHWORM

(PERICHAETA HUPEHENSIS)

I. Movements and Reactions.

Place a living worm in a dissecting tray and observe the direction and method of its movements. Study how it moves from place to place. Notice changes in diameter and changes in length. Describe the process carefully. Does the worm ever go backwards? Place it on its back and record the result. How does it get around obstacles?

Touch different parts of body with a needle to see which are most sensitive. How does it react to touch? Place a piece of moist filter paper in the tray to see how the worm reacts to moisture and dryness. Devise an experiment to see how it reacts to light.

Observe the dorsal blood vessel extending along the mid—dorsal line. What color is the blood?

II. External Characters.

Use a preserved worm. Keep the worm under water to prevent drying. Note that it is divided into segments or *somites;* how many somites are there? Are the somites all alike? If you find any that are different from the majority give their numbers. Find a dark brown region, the clitellum near the anterior end. Give the exact numbers of the segments included in the clitellum.

Is there antero-posterior differentiation? (i. e., are head and tail regions alike?) Dorso-ventral differentiation? (i. e., are dorsal and ventral surfaces alike?). Bilateral symmetry? (i. e., are the two sides of an imaginary middle line similar?).

Draw the worm gently through the fingers and feel the short bristles or setae on each segment. Examine these with a hand-lens. How many are there to each somite? How are they arranged? Count them on the 1st, 2nd, 3rd, 14th, 30th, 60th, and last segment.

The External Apertures.—Mouth: This is at the anterior end below an overhanging structure which looks like a piece of a somite, the *prostomium. Oviduct opening:* One in the middle of the 14th somite, ventral side. *Sperm duct openings:* conspicuous slits on the 18th somite, ventral side. *Spermatheca openings:* 3 pairs of slits, lying between somites 6 and 7, 7 and 8, 8 and 9. *Dorsal pores:* small round holes, one in each segment, beginning at 13th. How far posterior are they found? *Anus:* A vertical slit in the posterior somite. Mouth and anus are the two ends of the digestive or alimentary canal.

Make sketches of the first 20 and posterior 10 segments of the worm enlarged 2 diameters, illustrating all of the above mentioned points.

III. DISSECTION.

Stretch the worm out ventral side down in the dissection pan. Fasten it by pins through the anterior and posterior ends of the body. With scissors cut the dorsal skin through the median line from head to tail using great care to avoid cutting the alimentary canal. With forceps turn back the cut edges and pin them down. Take care not to injure the internal organs and tissues. Find the following:—

1. The coelom (the space between the body wall and the digestive tract), also called the body cavity.
2. The partitions which divide the body cavity or coelom into compartments, called septa.

A. *The Vascular System* (in part): Find the *dorsal blood vessel* and follow it to the anterior end; how many branches (hearts) does it give off to surround the alimentary canal? In which segments? Do you see any other branches?

NOTE.—(In dissecting it is best not to pin the body wall back except for the nervous and the reproductive systems. For other observation remove the dorsal wall in one worm and check it by removing the left lateral wall in another worm.)

B. *The Alimentarg Tract:* This runs the entire length and is differentiated as follows:—

a. *The buccal sac*—a sac into which the mouth opens.

b. *The pharynx*—a thick-walled muscular pouch lying behind the buccal sac. Find thread-like muscles attaching it to the body wall. What is their function?

c. *The oesophagus*—a short thin-walled tube extending through one or two somites.

d. *The crop*—enlargement of the tract occupying one segment.

e. *The gizzard*—a thick-walled muscular pouch. In which segment?

f. *The stomach-intestine*—a thin-walled tube extending from the gizzard to the anus.

g. *Intestinal caeca*—a pair of blind pouches attached to the intestine in segment 26.

Make a *careful drawing,* enlarged five or six diameters, showing these structures in the correct somites.

C. *Nervous System:* Find the *supra-oesophageal ganglia* or "brain" dorsal to the anterior end of the pharynx. In which somite is the brain? Find two nerves running to the brain from the skin of the prostomium, etc., two *circum-oesophageal commissures* passing from the brain, around the pharynx and uniting at the anterior end of the *ventral nerve* cord. Remove a piece of the ventral cord, mount and examine with low power. Can you find an enlargement or ganglion for each somite? Make out the arrangement of the *nerves.* How many in each segment? Draw nervous system of first 5 segments enlarged ten or more diameters.

D. *Reproductive System:* this is located between segments 6 and 18, mostly on the ventral side of the body cavity, but with some parts extending up to the dorsal side.

a. *Spermathecae*—three pairs of white organs in segments 7, 8, 9, lying at each side of and partly under oesophagus the and crop. What is their function?

b. *Seminal vesicles*—two pairs of conspicuous white masses surrounding the stomach-intestine, just posterior to the gizzard, about segments 11 and 12. These contain the testes.

c. *Sperm ducts*—fine white tubes on each side of the body, one from each seminal vesicle. The two on each side unite into one duct which continues posteriorly in the prostate gland in segment 18.

d. *Prostate glands*—a pair of conspicuous white rosettes in the 18th segment which are connected with the sperm duct, and the external opening seen previously on segment 18.

e. *Ovaries*—a pair of minute white bodies placed ventrally in segment 13.

f. *Oviducts*—two short tubes which receive the eggs from the ovaries and unite to open by one pore in segment 14.

Make a drawing to show this system in the proper relation to the segments.

E. *Excretory System*—can be found only by histological methods.

IV. CROSS SECTION—use prepared slide.

Place slide on the microscope in such a position that you see the section in its normal position, dorsal side up. Identify the *body wall*, the *coelom*, and the *alimentary canal*.

A. *Organs in the Coelom:* Keep in mind the relative positions of the organs in the worm you dissected.

a. *Ventral nerve cord* close to the body wall. See if any sections show nerves leaving it.

b. *Blood vessels*—Find *dorsal vessel* close to dorsal wall of alimentary canal, the *ventral vessel* below the alimentary canal, and the *subneural* ventral to the nerve cord.

B. *Body Wall:*

a. *Cuticle*—a thin transparent membrane on the outside. Is it cellular? (In some preparations it has been torn off.)

b. *Epidermis or skin*—containing many gland cells which produce the mucus which keeps the worm wet and slippery.

c. *Circular muscles*—What function do they have in locomotion?

d. *Longitudinal muscles*—These are cut transversely and will be seen in section. What is the shape of a muscle cell? What is the function of these in locomotion?

e. *Coelomic epithelium*—a thin layer of flat cells lining the body cavity.

C. *Alimentary Canal:* Be sure that you understand the position of the cavity in which the food lies.

a. *Epithelial lining*—of the canal, a layer of closely-packed columnar cells. Are they ciliated?

b. *Muscle layer*—similar to, but less extensive than the muscle layers of the body wall, that is, with both circular and longitudinal fibers. Longitudinal fibers are very few.

c. *Chlorogogue cells*—forming the outer layers.

Make three drawings.

1. An outline to show general shape of section, the location of the layers of tissues and the different organs. Do not put in details of cells.
2. A detailed drawing of a small section of the body wall.
3. A detailed drawing of a small section of the wall of the alimentary canal.

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Explanation of Figures

Figure 1.	Anterior portion of the body, ventral surface, external view.
Figure 2.	Posterior portion of the body, dorsal surface, external view.
Figure 3.	Anterior portion of the body, with the dorsal body wall removed, showing the internal organs in situ.
Figure 4.	Segments XXI to XXVII, with the dorsal body wall removed, showing the intestine and intestinal caeca.
Figure 5.	Anterior portion of the body, with the dorsal body wall removed, showing the nervous and reproductive systems.
Figure 6.	Anterior portion of the body, with the left lateral body wall removed, showing the septa and internal organs in situ.
Figure 7.	Anterior portion of the body, with the left lateral body wall removed, showing the reproductive organs.

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a—anus
aa—aortic arch
ag—accessory gland
ago—opening of accessory gland
bc—buccal cavity
cl—clitellum
cr—crop
dg—dorsal gland
dp—dorsal pore
dv—dorsal blood vessel
giz—gizzard
ic—intestinal caeca
int—intestine
m—mouth
mf—muscular fiber
n—nerve
od—oviduct
oe—oesophagus
ov—ovary
pr—prostomium
prg—prostate gland
s—setae
sboeg—sub-oesophageal ganglion
sep—septum
spmo—opening of spermathecae
spmth—spermathecae
spoeg—supra-oesophageal ganglion
sv—seminal vesicle
vc—ventral nerve cord
vd—vas deferens
vv—ventral blood vessel
♀—female genital opening
♂—male genital opening
I-CV—Segments 1 to 105

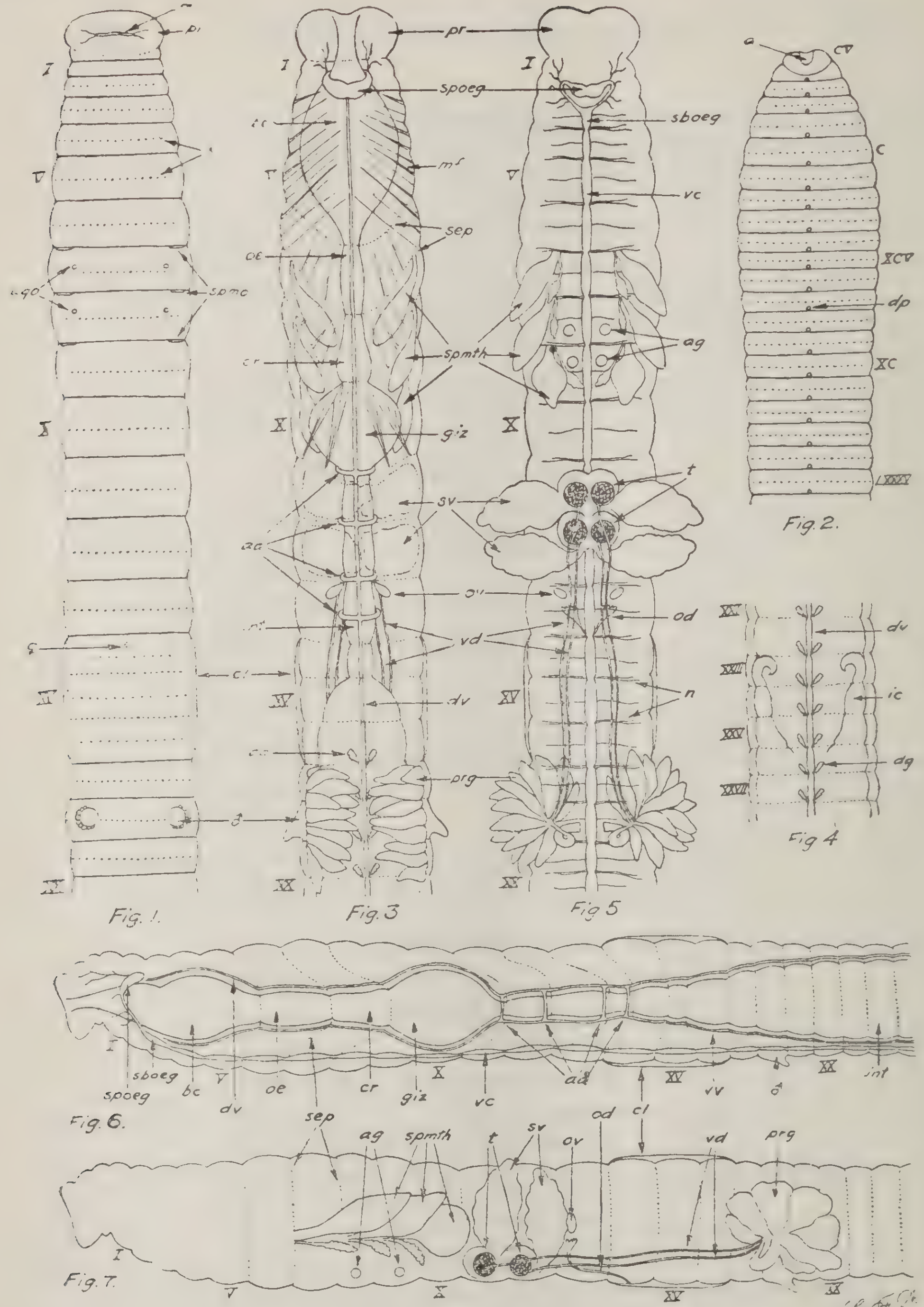

Fig. 1.

Fig. 2.

Fig. 3

Fig. 4

Fig. 5

Fig. 6.

Fig. 7.

PERICHAETA HUPEHENSIS MICHAELSON

CONTAGIOUS ABORTION OF CATTLE IN CHINA

By Charles S. Gibbs, Chen Ken and Sheo Piao

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Contagious abortion in cattle is a disease characterized by an inflammation of the female reproductive organs which results in the expulsion of the fetus (unborn calf) before it has sufficiently developed to live. This disease has been known in Europe for many years and is now quite prevalent in the United States, Canada, Australia, and New Zealand, countries into which European cattle have been imported in large numbers. Foreign cattle have been imported into China comparatively recently, probably within the last 30 years. Most of the foreign cattle are still found in outport cities, although there is hardly a large group of foreigners in any of the interior cities but have from one to a score or more of cattle. Some of these herds are made up of pedigreed stock. The most common breeds of foreign cattle introduced into China are Holsteins and Ayshires. Since these types of cattle give more milk and produce stronger oxen than the native yellow cows Chinese farmers and dairymen have purchased some of them. There is no doubt but short haired types of these breeds improve native cattle when crossed. In a few instances Missionaries have made it possible for interested farmers and dairymen to secure foreign cattle for the improving of their herds. Thus foreign cattle have found their way into China without veterinary inspection or quarantine of any kind. It is quite likely that infectious abortion will be introduced into China to stay if it has not been done already. The object of this paper is primarily to review the cases of this disease which the authors have found as complications in their rinderpest control work.

The first case was found in an imported cow in Shanghai during the summer of 1923. This was a heifer which had just been imported a few weeks before. A pure culture of the *Bacillus of Bang* or *Alkaligines abortus* was isolated from the dead fetus. The next case was found in a Chinese heifer in Nanking the following winter. This heifer was imported from Shanghai. But before leaving Shanghai the cow had been bred to a foreign bull. After this incident the heifer remained sterile although several attempts were made to breed her. A pure culture of *A. abortus* was isolated from the dead fetus. When killed six months later in the Nanking slaughter house the cow showed lesions of metritis.

These discoveries and others which have been made since led the authors to make comparative studies of the microorganisms isolated from aborting foreign and Chinese cattle to determine, if possible, whether these cases were really contagious abortion or anomalies of rinderpest. Hence six strains isolated from foreign cattle and four strains isolated from yellow cows were selected for this study. Two of the *A. abortus* cultures used in these experiments were secured from America. These two cultures were included in this study as controls, As far as could be determined by our laboratory tests all of the cultures belonged to the same group; that is the group known as *Alkaligines abortus*. The laboratory studies are recorded as follows:—

Morphology

Morphologically the organisms appeared as small polymorphic rods, with rounded ends varying in size from 0.4 to 0.5u wide, by 0.6 to 1.5u long, usually occurring singly, although sometimes found in pairs and hort chains of twos and threes. The controls stained more readily and clearly by Gram's method. They also grew more uniformly on artificial culture media than the newly isolated Chinese strains. All of the organisms were Gram negative. Endospores were not found in any of the cultures examined.

Motility

All of the microorganisms proved to be non-motile when examined in the hanging drop.

Oxygen Requirements

The oxygen requirements of the various strains differed. One of the controls was practically aerobic while the others would not grow unless the oxygen was reduced. The first strain isolated from the imported foreign cow in Shanghai was aerobic from the beginning. All of the other strains isolated from the fetuses of foreign and Chinese cattle grew only when the oxygen was replaced by hydrogen or reduced by means of *B. subtilis* sub-cultures.

Temperature Requirements

The temperature of the incubator varied from 32° to 37° C. daily. This slight variation did not seem to have any noticeable effect upon the cultures. But when the temperature was lowered or raised above these points the microorganisms did not grow.

Agar Colonies

In all of the agar colonies the surface colonies appeared as small transparent dew drops. After incubating for a day or two longer fine granules appeared in the centers of the colonies. The subsurface colonies developed very slowly. These colonies were oval or triangular in form, finely granular, and of a light brown color.

Agar Streaks

Streaks on slant agar were opalescent, lustrous, moist, entire, light amber color in direct light and a bluish metallic color in transmitted light.

Gelatine

In all of the cultures included in this study the growth in gelatine was beaded, scanty and without liquifaction.

Bouillon

The growth of the cultures in broth were uniform and characteristic of *A. abortus.* After 24 hours incubation a slight turbidity appeared. This turbidity, if undisturbed, settled to the bottom of the test tubes after three days. All of the cultures growing in plain broth produced slight alkaline reaction to litmus.

Litmus Milk

In litmus milk the cultures produced a slightly alkaline reaction after three or four days incubation.

Potato

A faint, smooth, glistening, yellowish-brown growth was produced on potato. On standing for ten days or two weeks, the growth increased but slightly while the color turned dark brown.

Carbohydrates

The reactions in carbohydrate media were characteristic. Gas was not produced in dextrose, lactose, sucrose, mannite and maltose. Acid was regularly formed only in dextrose and lactose.

Special Tests

Nitrates were not reduced to nitrites by any of the cultures. Ehrlich's test for indol formation was negative. The Thomas test for ammonia was positive only when the cultures were grown in urea and asparagin media.

Tests for Pathogenicity

All of the cultures were pathogenic to guinea pigs causing abortion and changing the blood serum from negative to positive agglutination.

Immunological Studies

As an aid to the study and diagnosis of this disease equipment and materials were secured for making the agglutination and complement fixation tests.

Since the agglutination test was simple and in the hands of most investigators just as satisfactory as the complement fixation test this was the test finally adopted for our work. The test was conducted as follows:—

Blood was collected from the jugular vein of the cow to be tested and set aside in a cool place until it clotted. Meanwhile several strains of *A. abortus* were grown on plain agar culture media to make an antigen suspension in carbolized saline solution. Just enough of the bacteria were placed in the carbolized saline solution to make it plainly cloudy to the eye. Then measured amounts of this suspension were placed in serological test tubes, four tubes being prepared for each animal tested. Then serum was added in such quantities that the first contained one part of serum to 50 parts of bacterial suspension, the second tube; 1 part of serum to 100 parts of suspension; the third tube 1 part to 200; while the fourth tube was kept as a control. The tubes were incubated for 24 hours at 35° C. At the end of this period the tubes were removed from the incubator and read. After the reading the tubes were shaken until it was impossible to distinguish positive from negative reactions. Then the tubes were placed in the incubator for the 48 hour reading. In this way the tests were read twice at different times. The 48 hour reading was helpful in checking up doubtful reactions.

The following table gives the results of the tests as applied to foreign cattle.

FOREIGN CATTLE—TABLE I.

Cow	*Tube Numbers*				
No.	1	2	3	4	
1	0	0	0	0	
2	0	+	+	+	
3	0	+	+	+	
4	0	+	?	0	Doubtful
5	0	+	+	+	
6	0	+	+	+	
7	0	0	0	0	
8	0	+	+	+	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	
17	0	+	+	+	
18	0	+	+	+	
19	0	+	+	+	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	+	+	+	
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	+	+	+	
31	0	+	+	+	
32	0	+	+	+	
33	0	+	+	+	
34	0	+	+	+	
35	0	+	+	+	
36	0	+	+	+	
37	0	0	0	0	
38	0	0	0	0	
39	0	0	0	0	
40	0	+	+	+	
41	0	0	0	0	
42	0	0	0	0	
43	0	0	0	0	
44	0	0	0	0	
45	0	0	0	0	
46	0	0	0	0	

FOREIGN CATTLE—TABLE I. (*Con.*)

Cow	*Tube Numbers*				
No.	1	2	3	4	
47	0	0	0	0	
48	0	0	0	0	
49	0	0	0	0	
50	0	0	0	0	
51	0	0	0	0	
52	0	0	0	0	
53	0	0	0	0	
54	0	0	0	0	
55	0	+	+	+	
56	0	+	+	+	
57	0	+	+	+	
58	0	+	+	+	
59	0	0	0	0	
60	0	0	0	0	
61	0	+	+	+	
62	0	0	0	0	
63	0	+	+	+	
64	0	0	0	0	
65	0	0	0	0	
66	0	0	0	0	
67	0	0	0	0	
68	0	+	+	+	
69	0	+	+	+	
70	0	+	+	+	
71	0	?	0	0	Doubtful
72	0	0	0	0	
73	0	+	+	+	
74	0	0	0	0	
75	0	0	0	0	
76	0	0	0	0	
77	0	0	0	0	
78	0	0	0	0	
79	0	0	0	0	
80	0	0	0	0	
81	0	0	0	0	
82	0	+	+	+	
83	0	0	0	0	
84	0	0	0	0	
85	0	+	+	+	
86	0	0	0	0	
87	0	0	0	0	
88	0	+	+	+	
89	0	0	0	0	
90	0	0	0	0	
91	0	0	0	0	
92	0	0	0	0	
93	0	0	0	0	
94	0	0	0	0	
95	0	0	0	0	
96	0	0	0	0	
97	0	0	0	0	
98	0	0	0	0	
99	0	0	0	0	
100	0	0	0	0	
101	0	0	0	0	
102	0	+	+	+	
103	0	0	0	0	
104	0	+	+	+	
105	0	+	+	+	
106	0	0	0	0	
107	0	0	0	0	
108	0	+	+	+	
109	0	+	+	+	
110	0	0	0	0	
111	0	0	0	0	
112	0	0	0	0	
113	0	0	0	0	
114	0	0	0	0	
115	0	0	0	0	
116	0	0	0	0	
117	0	0	0	0	
118	0	0	0	0	
119	0	0	0	0	
120	0	0	0	0	
121	0	0	0	0	
122	0	+	+	+	
123	0	0	0	0	
124	0	0	0	0	
125	0	+	+	+	
126	0	+	+	+	
127	0	0	0	0	
128	0	0	0	0	

Thus one hundred and twenty-eight head of foreign cattle were tested for infectious abortion by the agglutination test. Eighty-eight of these cattle were negative, thirty-eight gave positive reactions while two were classified as doubtful. In other words 69.1 per cent of the cattle treated did not have infectious abortion; 29.6 per cent were infected with the disease and 1.3 per cent were probably just coming down with the disease since they were found in recently infected herds and gave doubtful reactions.

Twenty-five head of native yellow cows were tested for infectious abortion by the agglutination test as follows :—

TABLE II.

Cow	*Tube Numbers*			
No.	1	2	3	4
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	+	+	+
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	+	+	+
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0

It will be seen from the above table that twenty-three or 92 per cent of the yellow cows were non-reactors and two or 8 per cent were positive reactors. Both of the reacting animals were found in a herd from which two aborting animals had previously been eradicated. The disease was undoubtedly brought into this herd by a heifer which had been bred to a foreign bull in Shanghai.

Since native water buffaloes are not as susceptible to rinderpest as other breeds of cattle in East China the authors did not have opportunity to study them the same as they did herds of foreign and yellow cows. In order to make up for this deficiency in this study of infectious abortion blood was collected from sixty-three water buffalo cows killed in the Nanking slaughter house and tested by the agglutination test for infectious abortion. As a rule the most undesirable cattle find their way to the slaughter house. An infected aborting cow is certainly an unprofitable animal to keep. If infectious abortion is contagious to water buffaloes, animals suffering from this disease would in the ordinary course of events find their way to the butcher shop. The results of this investigation are recorded as follows :—

TABLE III.

Cow	*Tube Numbers*				
No.	1	2	3	4	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7	0	0	0	0	
8	0	0	0	0	
9	0	+	0	0	Doubtful
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	

TABLE III. (*Con.*)

Cow	*Tube Numbers*					*Cow*	*Tube Numbers*			
No.	1	2	3	4		No.	1	2	3	4
17	0	+	0	0	Doubtful	41	0	0	0	0
18	0	0	0	0		42	0	0	0	0
19	0	0	0	0		43	0	0	0	0
20	0	+	0	0	Doubtful	44	0	0	0	0
21	0	0	0	0		45	0	0	0	0
22	0	0	0	0		46	0	0	0	0
23	0	0	0	0		47	0	0	0	0
24	0	0	0	0		48	0	0	0	0
25	0	0	0	0		49	0	0	0	0
26	0	+	+	+		50	0	0	0	0
27	0	0	0	0		51	0	0	0	0
28	0	0	0	0		52	0	0	0	0
29	0	0	0	0		53	0	0	0	0
30	0	+	+	+		54	0	0	0	0
31	0	0	0	0		55	0	0	0	0
32	0	0	0	0		56	0	0	0	0
33	0	0	0	0		57	0	0	0	0
34	0	0	0	0		58	0	0	0	0
35	0	0	0	0		59	0	0	0	0
36	0	0	0	0		60	0	0	0	0
37	0	0	0	0		61	0	+	+	+
38	0	0	0	0		62	0	0	0	0
39	0	0	0	0		63	0	0	0	0
40	0	0	0	0						

According to the above table fifty-seven or 90.6 per cent of the water buffaloes gave no reaction when their blood serum was titrated against *A. abortus* antigen. Three or 4.7 per cent gave weak positive reactions. In the regular routine agglutination test for infectious abortion in cattle these reactors would have been pronounced doubtful. There were still three others or 4.7 per cent that gave strong positive reactions. In the absence of clinical symptoms we would not be justified in stating definitely that the six water buffaloes mentioned above, as giving positive agglutination tests, had infectious abortion because we have no evidence that this animal is susceptible to this disease.

Our experience and investigations indicate that contagious abortion is being introduced into China by the importation of diseased foreign cattle. While native yellow cattle are susceptible to this disease we have not found any of them infected without a previous history of association with foreign cattle in outport cities. In our experiences rinderpest is practically always fatal to cattle infected with the abortion disease. It may be that rinderpest acts as a cleansing fire keeping the cattle of China free of contagious abortion. However our investigations are not complete. We are publishing our results hoping that others will have opportunity to finish them.

THE CONTROL OF STOMACH WORMS IN THE GOAT*

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Stomach worms were found, in our studies, to be especially common in imported foreign goats in East China. The most serious effects of these worm infestations were noticed in kid-goats. In these animals the disease nearly always ran an acute course killing the little goats in about a week. In the matured goats the disease usually took a chronic course. These carriers while excreting many eggs and larvae usually did not develop any other symptoms of the disease until they had been infected a long time. In one of our experiments we actually demonstrated the presence of eggs and larvae in two apparently healthy goats for one and one-half years before any other symptoms of the disease appeared.

The first symptoms noticed in infected goats were dullness and lack of thrift. Later the skin and mucous membrane of the mouth and eyes turned pale, while watery swellings appeared under the jaws. Diarrhea was a common symptom owing to the irritation of the mucous membrane of the fourth stomach. In bad cases the belly bloated, the wool dropped out, and the skin became unusually pale and colorless. Death took place in a few days after marked symptoms and great weakness appeared. But in the old goats the symptoms developed slowly. Many of them lived for months stumbling around, because they did not have strength enough to stand and walk any distance. The weakness first appeared in the hind legs as a kind of stiffening of the muscles so that the animals could not walk without tripping or reeling and falling. Later the weakness appeared in the forelegs and gradually extended to other parts of the body until the worm infested goats died in a prostrated condition.

Several goats dying of this disease were autopsied immediately after death. In all cases stomach worms *(Haemonchus contortus)* were found in the fourth stomach. When the contents of the stomach were carefully poured out, many of the worms remained attached to the mucous membrane, and by careful picking and washing, thousands of these worms were collected free of food particles for examination and study. Further inspection of the stomach revealed pin-point punctures caused by bites of the worms. Usually there were more of the wounds than there were worms because the parasites had a habit of attacking one point for a while and then moving to other places, leaving the old points of attachment bleeding for some time afterward. These studies indicate that the stomach worm is a blood sucker. It seems to live entirely on the blood abstracted from the mucous membrane of the fourth stomach of the host. In this way the goats were weakened by the loss of blood taken by the parasites.

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*Most of the material in this article was abstracted from a thesis presented by Mr. Sheo Piao to the Faculty of the College of Agriculture and Forestry, the University of Nanking, in fulfilment of the requirements for the degree of Bachelor of Science in Agriculture, June 1926.

Microscopical studies of the worms revealed the fact that the females did most of the harm to the goats. Usually the females were filled with blood which they had taken from the goats. This made them very conspicuous and easily singled out for special study and observation. The males, on the other hand, were nearly colorless and smaller than the females. Careful measurements indicated that the length of the females averaged from 18 mm. to 30 mm., while the males varied only from 10 mm. to 20 mm. in length. One other interesting feature of these worms was the coiled appearance of the ovaries in the females. These organs were so arranged that they appeared to be rolled spirally around the intestine giving a twisted effect to the shape of the body. Probably because of this twisted effect which appears in the female only the name *contortus* has been given to this species of worm. Further distinguishing characteristics of these worms were observed as follows. The tail of the male was terminated by a bursa consisting of two long lobes and a small lobe accessory to the right; there were two spicules between the long lobes. The tail of the females was acutely pointed. The vulva was found in the posterior fifth of the body as a small slit-like opening. The eggs were visible through the body wall as elongated oval bodies measuring 70 to 75 microns long by 43 to 54 microns wide. In some of the females the eggs contained developed embryos apparently ready for deposition. The matured eggs readily hatched when placed in warm water ranging from 25°C. to 37°C. The embryos at the time of release measured from 300 to 400 microns in length by 17 to 21 microns in width. When the temperature of the water was kept below 22°C. the eggs did not hatch, but remained dormant for two and three months respectively, finally hatching out when the temperature was raised to the optimum as stated above. Both drying and freezing killed the eggs as well as the very young larvae. Because of rapid putrefaction and decomposition of goat feces in the incubator we did not succeed in hatching any eggs in this material.

Our studies on the life cycle of stomach worms in the goats can be briefly outlined as follows. First, the worms mate in the fourth stomach of the host and as a result of this mating, hundreds of fertilized eggs are passed out of the body in the feces, thus scattering the infection everywhere the goats go. Under favorable conditions of temperature and moisture the embryos develop. Sometimes, perhaps, the unsuspecting goats pick up the larvae from the dew on blades of grass in infected pastures. At other times the infection may be conveyed to the goats by contaminated drinking water. In any case the cycle of infeciton is so little understood that in seriously infested regions it is next to impossible to control the disease by sanitary measures.

Probably the most satisfactory method for keeping stomach worms in check in China is the frequent administration of drugs to expel the parasites. There are several drenches recommended for removing stomach worms from sheep, such as copper sulphate solution, nicotine sulphate solution, and a combination of copper and nicotine sulphate solutions.

In the beginning we did not know that any of the solutions would be effective in removing stomach worms from goats. But since sheep and goats are quite closely related and the worms seem to be the same in both animals we considered the chemicals worth trying in view of the destructiveness of the disease. In addition we had to determine the dose and the frequency of administration to effectually control the worms in goats. However, very soon after the experiment started we learned that in order to get the full effect of any of the drenches upon the worms in the stomach of the goats, the animals had to be deprived of food and water for at least twelve hours before and after treatments. Moreover we found that the chemicals were less poisonous to the goats when given at a time when no absorption of food was taking place in the digestive tract.

In drenching, a long-necked bottle was used. The dose was first measured off in a graduated cylinder and poured into the bottle. The neck of the bottle was placed between the back-teeth in the mouth of the goat, while at the same time the head was raised just enough so that the liquid would slowly run down the esophagus without spilling. Meanwhile the goat was held in a standing position so as to avoid as much struggling as possible. Furthermore care was taken not to lift the head of the animal too high in order to prevent choking and the flowing of the medicine into the lungs. Apparently this method permitted the vermicide to pass quickly into the fourth stomach undiluted by food or other substances.

Since copper sulphate seemed to be most widely recommended for the treatment of stomoch worms in sheep, we decided to try it first. The solution is usually prepared by dissolving one pound of pure copper sulphate crystals in 9½ U.S. gallons of water. First one pound of the clear, blue crystals are weighed out. The white anhydrous copper sulphate should not be used because it has no effect upon the worms. Next the crystals are carefully dissolved in about one gallon of boiling water. When this is accomplished the required dilution is made by adding cold water slowly and mixing thoroughly.

The doses ordinarily recommended for sheep are as follows:—

3	months old lamb give	¾ ounce
6	,, ,, ,, ,,	1½ ,,
12	,, ,, ,, ,,	2½ to 3 ounces
	sheep	3½ ,,

Eight infected goats were dosed monthly by the copper sulphate solution as stated above for sheep for two years. During this period one hundred and forty-eight doses were given and in spite of the treatments three goats died of stomach worms. This indicated a mortality of 37.5 per cent. Apparently copper sulphate, in the same doses, is not as effective for controlling stomach worms in goats as it is in sheep. During this trial the feces of the goats were examined microscopically for worms before and after treatments with copper sulphate solution. The microscopical test for worms was made by taking some of the fresh feces from each goat and grinding each specimen separately in a mortar, a little distilled water being added from time to time until a thin paste was formed. A drop of this paste was placed on a slide, covered with a cover glass and examined with a high powered microscope. At no time were any of the goats found free of infection.

The results of the microscopical examinations of the feces of the goats when the copper sulphate treatments were commenced in October 1922 are recorded in Table I.

TABLE I.

Goat	*Ova, Larvae*	*Condition of Goat*
Large Billy Goat	+	Anaemic
Big Nanny	+	..
Garden Goat	+	..
Goat No. 1	+	..
Goat No. 2	+	,,
Goat No. 3	+	Apparently Healthy
Goat No. 4	+	.. ..
Old Mother Goat	+	.. ..

The results of the copper sulphate treatments at the end of the experiments in October, 1924 were as follows:—

TABLE II.

Goat	*Ova, Larvae*	*Condition of Goat*
Large Billy Goat	+	Unimproved
Big Nanny Goat	+	Improved
Garden Goat	+	Died
Goat No. 1	+	..
Goat No. 2	+	..
Goat No. 3	+	Apparently Healthy
Goat No. 4	+	.. ,,
Old Mother Goat	+	,, ,,

Next nicotine sulphate solution was tried. This method has been used successfully for the control of stomach worms in sheep by Lamson, at the Storrs Agricultural Experiment Station, Storrs, Connecticut, U.S.A. Lamson found "that nicotine sulphate could be used in one of three strengths, namely, by adding one teaspoonful of Black Leaf 40 to a quart of water, and giving four ounces of this to an adult sheep, and two ounces to a lamb over three months old; or adding two spoonfuls to the quart, or three spoonfuls to a quart and giving the same doses. The one teaspoonful strength was used only for weak animals, two teaspoonfuls were used for the average sheep and lamb, while three teaspoonfuls were given successfully to strong animals only."

The nicotine sulphate treatment was tried for one year, in seven goats infected with stomach worms. During this trial, one old billy goat died of stomach worms and an old nanny goat went through the whole course of treatment without being improved. The nicotine sulphate solutions even in the strongest doses recommended for sheep by Lamson did not seem to be poisonous to the goats. Yet the monthly microscopic examinations of the droppings indicated that the goats were never entirely freed of worms, although many worms were excreted apparently dead for two or three days after the vermifuge was given.

The results of the microscopical examinations of the feces of the goats at the time the nicotine sulphate treatment was commenced in November, 1924 are contained in the following table:—

TABLE III.

Goat	*Ova, Larvae*	*General Condition of Goat*
Large Billy Goat	+	Anemic
Big Nanny Goat	+	Apparently Healthy
Goat No. 3	+	,, ,,
Goat No. 4	+	,, ,,
Old Mother Goat	+	,, ,,
Little Billy Goat	+	,, ,,
Little Nanny Goat	+	,, ,,

The results of the microscopical examinations of the feces when the nicotine sulphate treatments were discontinued in December, 1925 are as follows:—

TABLE IV.

Goat	*Ova, Larvae*	*General Condition of Goat*
Large Billy Goat	+	Dead
Big Nanny Goat	+	Poor, slightly anemic
Goat No. 3	+	Apparently Healthy
Goat No. 4	+	,, ,,

TABLE IV. (*Con.*)

Goat	*Ova, Larvae*	*General Condition of Goat*
Old Mother Goat	+	Apparently Healthy
Little Billy Goat	+	,, ,,
Little Nanny Goat	+	,, ,,

The nicotine-copper sulphate mixture treatment was tried for the remaining seven months as a vermifuge for the control of stomach worms in six badly infected goats. The nicotine sulphate and the copper sulphate were mixed in the proportions recommended for the control of stomach worms in sheep, i.e. one-fourth pound of the blue crystals of copper sulphate were dissolved in a pint of boiling water. Then one-fourth pound of snuff or powdered tobacco was steeped for 10 or 12 hours in a quart of water. Then the two solutions were put together and enough water added to make a total of three gallons of the mixture. After filtering clear of large pieces this mixture was placed in clean, stoppered bottles ready for the treatments.

The following doses were found by us to be most satisfactory after fasting the goats for twelve hours.

For kids	3 months old	... ...	¾	ounce.
.. ..	6 ,, ,,	... ...	1½	..
.. ..	12 ,, ,,	... ...	2½	..
.. ..	18 .. ,,	... ...	3	..
.. goats	2 years old	... ...	3½	..

The goats were drenched every month for seven months in succession. The nanny goat which had not been improved with nicotine sulphate was also placed on this experiment. Preliminary to treatments the goats were confined for twelve hours without food or water. After drenching the goats were returned to the pens and fasted for twelve hours longer, thus requiring twenty-four hours for a complete treatment.

Between the treatments the goats went about to graze daily from eight in the morning till three or four o'clock in the afternoon. In the afternoon the goats were driven back to the farmyard and fed rice straw. Of course this ration was not very nourishing during the winter months while the stubble in the fields was short and dry. Besides the goats were being milked every day. Consequently they got rather lean before the season was over. Since goats, sheep and other beasts were permitted to roam over the fields at will, grazing one after another, it is but natural that goats would be exposed to stomach worm infection when their resistance was low. However, this is a condition that most goats are compelled to endure in Nanking every year. Also it is a test which the copper sulphate and nicotine sulphate solutions were not able to stand up under. Hence in order to make a fair comparative study of the three treatments we gave the nicotine-copper sulphate mixture in the winter and early spring when the goats were not in good condition.

The results of the microscopical examinations of the feces when the nicotine-copper sulphate treatment was begun in January, 1926, follow.

TABLE V.

Goat	*Ova, Larvae*	*Condition of Goat*
Little Billy Goat	+	Apparently Healthy
Old Mother Goat	+	.. ..
Litte Nanny Goat	+	.. ..
Goat No. 3	+	.. ..
Goat No. 4	+	,, ,,
Big Nanny Goat	+	Anemic, with swellings under the jaw

The results of the microscopical exminations of the feces after one month's treatment by the nicotine-copper sulphate mixture are as follows:—

TABLE VI.

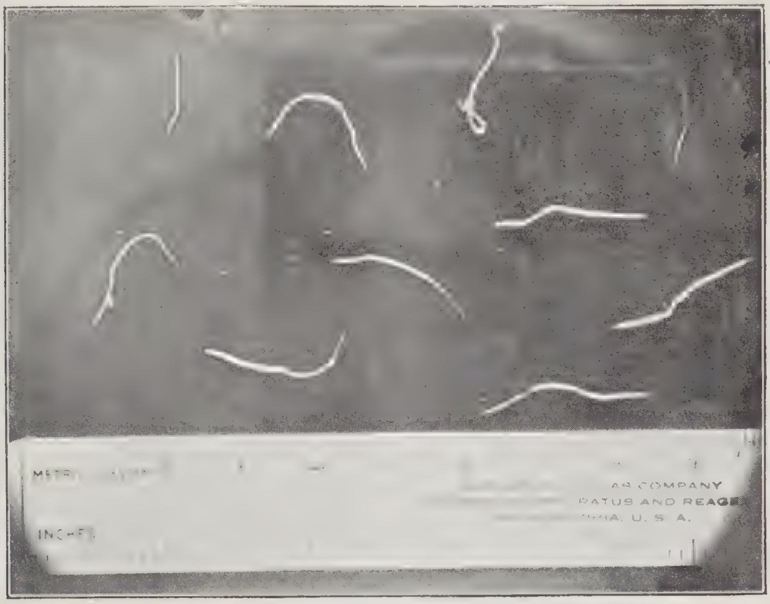
Goat	*Ova, Larvae*	*Condition of Goat*
Little Billy Goat	0	Healthy
Old Mother Goat	0	..
Little Nanny Goat	0	..
Goat No. 3	0	..
Goat No. 4	0	,,
Big Nanny Goat	0	Slightly Improved

The results of the microscopical examinations of the feces after two months treatments by the nicotine-copper sulphate were the same.

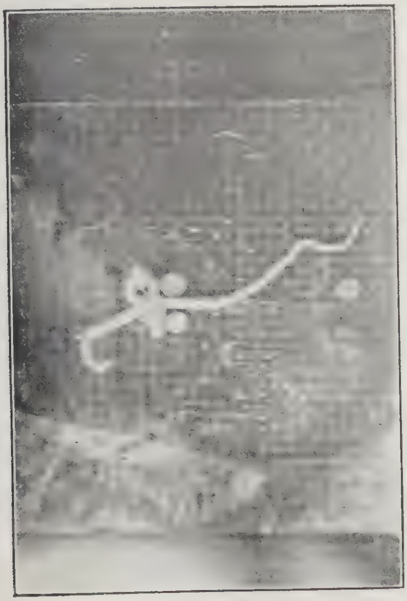
TABLE VII.

Goat	*Ova, Larvae*	*Condition of Goat*
Little Billy Goat	0	Healthy
Old Mother Goat	0	..
Little Nanny Goat	0	..
Goat No. 3	0	..
Goat No. 4	0	,,
Big Nanny Goat	0	Improved

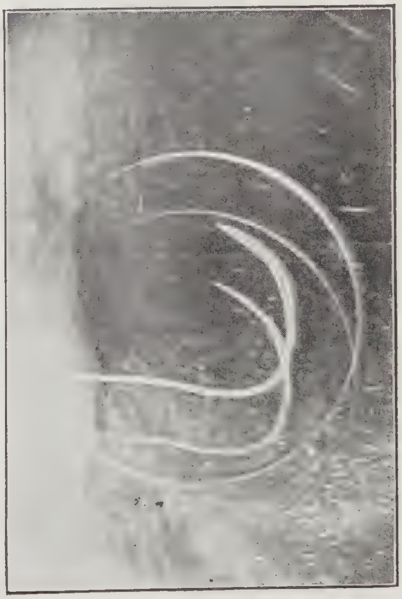
The treatments were continued for five months after the results in table VII were secured. The nicotine-copper sulphate mixture seemed to control the worms absolutely. None of the goats were found to be infected again during this period. The Big Nanny goat recovered entirely from the effects of the disease. Six months later she dropped a healthy kid. However, in a worm infected region like Nanking the nicotine-copper sulphate mixture treatment probably is a preventive rather than a cure.



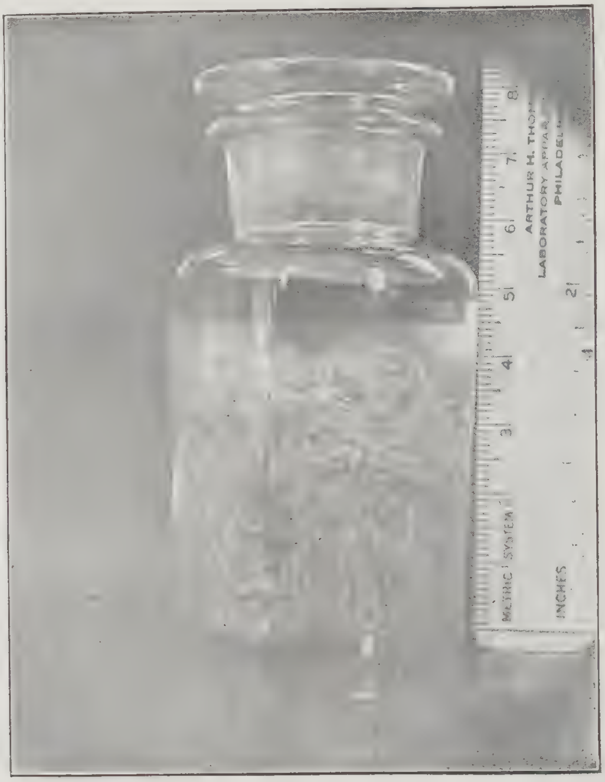
Stomach Worms from Goat—Natural Size.



Stomach Worm-Male-Magnified
Four Diameters.



Stomach Worm—Female—Magnified
Four Diameters.



Stomach Worms Removed From a Dead Goat.

Nanny Goat Recovering from Stomach Worm Infection after Treatment with Nicotine—Copper Sulphate Mixture.

Nanny Goat Unimproved by Nicotine Sulphate Drenches.
Note poor Condition and the Roughled Appearance of the Coat.

NOTE ON A CHINESE VEGETABLE DYE *

By F. A. McClure

Agricultural Explorer, U.S.D.A., Assistant Professor of Botany, Lingnan University.

There is in use in a number of centers in this province, namely at Tung Koon (東莞), Shek Lung (石龍), near Kowloon (九龍) in Hongkong Territory, and in several villages near Canton, including Ng Ngaan K'iu (五眼橋) and Im Po (鹽步), a very interesting brown dye known locally as *shue leung* (薯莨). It comes from the tubers of *Dioscorea rhipogonoides* Oliv., a congener of the true yams. This plant is a twining vine with smooth, shiny, leathery, ovate leaves and slender, tough stems which bear short, sharp hooks. The tubers are subglobose in shape, often with a constriction about the middle, and very rough, being covered with a corky bark which increases in thickness with age.

Dioscorea rhipogonoides Oliv. is native to the hills of Kwangtung (廣東) and Kwangsai (廣西). The supply of its tubers for the local dyeing industry comes largely from the West River district of the two provinces. These are not only collected from the wild, but are also cultivated on the hillsides. Seeds are sometimes planted, but the usual practice is to plant small tubers for the sake of economy of time in the development of a marketable product. This is said to take at least three years. Luk To (六都) is the most popular market for these tubers in this province, and representatives from the dye houses near Canton go there personally and buy the tubers in great quantities. It is interesting to note, however, that most dyers advertise their output as having been dyed only with tubers from Lung Chow (龍洲) in Kwangsai province.

The tubers are sold by the picul[1] and the price per picul varies from $1.00 or $2.00 to $11.00 or 12.00,[2] depending upon the quality of the tubers and the balance of supply and demand. The quality of the tubers is judged upon the basis of their yield of the dark brown, sticky sap which contains the dye principle. Generally speaking, this yield is higher per given weight with mature tubers than with young ones. They must be used while fresh, however, in order te get the maximum yield.

Shue leung is used to dye a great variety of things, including chopsticks, fish nets, and plain cotton cloth, but the process as here described deals with the dyeing of silk, for which purpose by far the greater part of the supply consumed is used. The product, which is often spoken of as "Coolie Cloth," is usually black on the right side and buff to dark brown on the reverse. However, in some cases both sides may be black, and in others both sides may be brown. The general name applied by the Chinese to silk dyed by this process is *shue leung ch'au* (薯莨綢). Silk of a wide variety of weaves is used, each being known by a distinctive name. The patterns in those of fancy weave are formed by crossing the threads of the warp.

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* Contribution from the Biological Laboratory.

[1] One picul equals 100 catties or 133 English pounds.

[2] $1.00 Local Currency is approximately equivalent to $0.50 U. S. Currency.

The silk for dyeing by the process herein described comes most commonly in strips about 60cm. in width and 18.6m. in length[3]. Certain kinds come in strips about 68cm. wide and 16m. long. They are put up in tight, cylindrical rolls called, in Chinese, *p'at* (疋). Each strip is marked with the name of the maker, either by means of a wooden stamp and red or black ink, or by means of characters woven into the cloth. When the wholesale dealer secures the silk in the raw, undyed state he affixes to the strips the stamp of his shop. He may have his own dye establishment, but often the work is done by independent houses.

The preparation of the dye is all done by hand in a very primitive manner. By means of a coarse grater, consisting of a heavy board to which is attached a thin piece of sheet iron so perforated as to be provided with vertical teeth, the tubers are reduced to a pulp which is allowed to fall directly into large tubs of cold water. When the suspension reaches the consistency of thin batter the pulp is thoroughly mixed and rubbed by hand in order to assist in the extraction of the dye. The pulp is then strained from the liquid by means of a bamboo basket into which the contents of the vat are dipped, the liquid being allowed to flow into a second wooden vessel. The liquid is then diluted to the desired concentration and heated in a large, shallow, brass vessel.

The dye rapidly loses its effectiveness and a fresh solution must be prepared each day in order to get the best results. That which has been used is given or sold at a low rate to housewives who wish to dye small pieces of cloth for themselves, or to fishermen for dyeing their nets. The residue of grated tubers is dried in the sun and used as fuel.

In preparing the strips of silk for dyeing, the dyer first boils them in soda, either a refined product composed of transparent crystals or the unrefined form being used. This treatment is common to all processes by which cloth is dyed, and its purpose is the removal of the fat which would interfere with the action of the dye. Loops of coarse linen cloth are then sewed on to either end of the strips, and along each side, at intervals of 9 or 10cm., loops of strong linen thread are attached for the purpose of stretching the strips during the early stages of the process. This being done the whole strips are placed, singly, into an oblong wooden vessel with low sides and with a horizontal wooden bar supported at a height of about one meter upon staves, of appropriate length, at either end. The warm solution is then poured in and when the silk has become thoroughly wetted the strip is drawn over into an empty vessel, being pulled progressively from end to end across the horizontal bar, which causes the excess liquid to drain back into the dipping vat. The strip is then stretched immediately upon the sunning field by means of stout sticks placed horizontally thru the linen loops at either end, and stout stakes driven into the ground. Having been stretched lengthwise to a moderate tightness, the strip is then further stretched laterally by means of small bamboo stakes inserted in the loops of thread at the edges.

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[3] The Chinese dimensions of these standard strips are: width, 1 ft. 7 in., and length, 48 ft.

At this point a few words about the sunning field are in order. It is a smooth, level expanse of turf, carpeted with some low-growing grass, commonly Bermuda grass (*Cynodon dactylon* Pers.), which is kept in remarkably pure stand by the constant weeding out of any other grasses that spring up.

Owing to the fact that it is not possible to stretch the cloth perfectly level, tiny puddles of the dyeing liquid tend to collect in the slight depressions, particularly if the drying weather is not ideal, and it is often necessary, in order to prevent spotting, to disperse this liquid. This is done by means of passing over the surface a soft, trailing, mop-like brush made of the long, slender, tapering segments of the leaves of the fan palm (*Livistona chinensis* Mart.).

Exposure to the sunlight and air causes the dye gradually to turn from straw color to reddish brown. But one application is not sufficient to secure the desired shade. As soon as the strips are dry they are again dipped in the manner described above. After the first few times it is not necessary to stretch the cloth by means of stakes, since it becomes increasingly stiff with each application of the dye. Bamboo poles laid crosswise of the strips prevent their being overturned by the wind. The same side of the cloth is exposed to the light each time, with the result that this side becomes much darker in hue than the under side. When, after repeated dippings, which sometimes number thirty or more, the silk has reached the desired shade, it is ready for the next step in the process, which consists of the application of mud to the side which has been exposed to the sun.

When a considerable number of strips have reached this stage they are spread full length, upon a level strip of paving, one upon another, with the darker side of each uppermost. With a man at either end to prevent the strips from being disarranged, six men, each armed with a soft broom made of coconut fiber, quickly smear the uppermost surface with mud from large earthen jars conveniently located. The mud used is the ordinary river mud, called by the Chinese, *hoi nai* (海坭), which, in dried form, is so commonly used by Chinese gardeners for potting flowers. It is mixed with water until it is of a thin, smooth consistency. Care is taken, however, that it shall not contain so much water that it will penetrate the closewoven silk, but will remain merely a surface coating. The mud contains some chemical compound which acts as a mordant, reacting with the dye with which the silk has been impregnated and turning it jet black. Care is exerted to prevent the mud from coming into contact with the reverse side of the cloth.

The strips are smeared with mud in rapid succession and spread out upon an adjacent expanse of clean sand where they are allowed to remain for ten or fifteen minutes, after which they are washed in a nearby canal or stream. Having been spread upon the grass and dried they are dipped for the last time in the hot dye solution and again dried. Finally they are allowed to become slightly moist with dew and while in this condition are rolled into tight rolls.

The next step consists of softening the cloth and correcting any variations in its width which may have resulted from the rough process through which the strips have been put. This work is done at small, smooth-topped wooden tables of convenient height, at each of which one worker stands. Each strip is gradually unrolled, being stretched in a diagonal direction every few inches. It is then reversed and stretched in the opposite direction. This stretching process breaks up the network of dried mucilaginous dye material with which the fibers of the cloth have become surrounded. The worker then begins at one end and makes the strip into a tight, even roll, measuring its width at frequent intervals and correcting any variations from the original width by stretching the cloth laterally or longitudinally as the case requires. This completes the process and the rolls are now ready to be returned to the wholesaler. The approximate charges levied in local currency for dyeing each strip of silk are indicated in the table below.

	Application of the Dye	*Application of the Mordant*	*Total Charge per Strip*
Silk of plain weave	$4.00	$0.50	$4.50
Silk of fancy weave	$5.00	$0.50	$5.50

Excessively dry weather being unfavorable to the satisfactory carrying out of the process, work is usually discontinued during the latter part of the dry season and is not resumed until after the Chinese New Year Holiday. The off season thus extends approximately from the end of November to the first of March.

Garments made from the different grades and varieties of this silk are worn in Canton and throughout this province by Chinese in all strata of society. It is at once easily laundered, requiring no ironing,

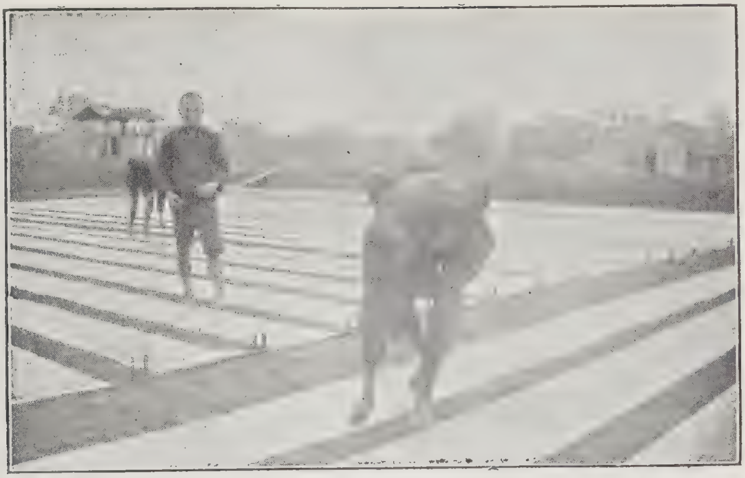

Fig. 1. Staking down the strips of silk at the beginning of the process.

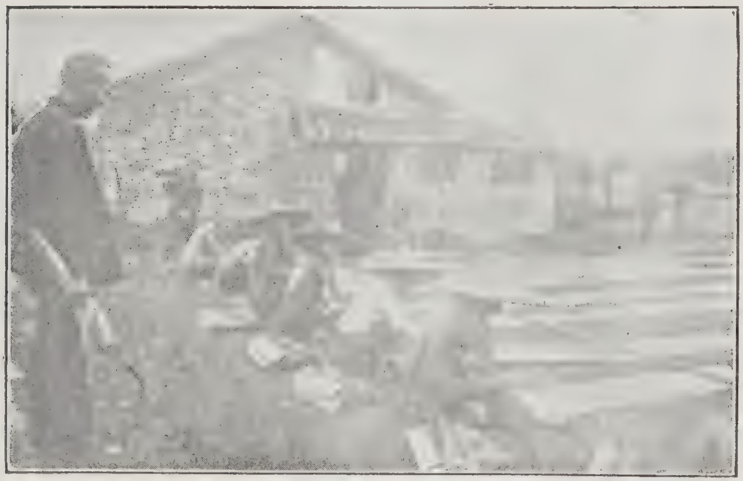

Fig. 2. Later stage in the process; taking up the strips for further dipping. At this stage the strips are not staked down, but are held in place by bamboo poles.

Fig. 3. Applying mud to the strips of silk. In the foreground the strips may be seen spread out upon the sand.

and very durable. A number of instances of the remarkable wearing qualities of this cloth have been called to my attention. I saw recently a jacket made of it which was said to have been in use for fifteen years. Another quality of this material, one which makes it popular for hot weather wear, is its smooth, stiff texture, somewhat similar to that imparted by a slight application of starch, which causes it to keep its shape well and keeps it from adhering to the skin.

There is a widespread and very curious belief with regard to the proper treatment of newly made garments made of silk dyed with *shue leung*, in order to insure the best possible service from them. The treatment prescribed is as follows: Wear the garment at strenuous work, or by other means saturate it with perspiration. Wad it up (do not fold it) and lay it aside until it molds thoroughly. Saturate it with fresh lard, working it in well. Wash it in warm soft water to which has been added the juice of boiled garlic. This treatment is said not only to add greatly to the durability of the fibers, but to increase the fastness of the color. Certain varieties of this cloth are sold without having been blackened by the application of mud. These are said to turn black slowly under the action of perspiration.

The retail price of the different varieties and grades of this silk ranges from $0.30 per Chinese foot for the poorest, to about $1.00 for the best. This is equivalent to about $0.15 to $0.50, U. S. Currency, per yard.

THE CULTIVATION OF BELLADONNA, HYOSCYAMUS, AND DIGITALIS, IN CHINA

By J. C. Liu

Department of Pharmacology, Peking Union Medical College, Peking.

Continuing the work of drug cultivation in Peking particular emphasis was placed this year upon belladonna, hyoscyamus and digitalis. These highly potent medicinal plants if adaptable to Chinese soil would prove of great value. Hyoscyamus has been found in the wild state in North China but it is not abundant, and there seems to be considerable confusion in Chinese literature concerning its identity.*

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* Far Eastern Association of Tropical Medicine, 6 th Congress Report.

While we were unable to complete our experiment in one year, the biennials, hyoscyamus and digitalis, show promise of yielding good flowering plants next year, when we hope to have seed for distribution.

Foreign seeds of a number of other plants were planted and satisfactory plant specimens obtained for comparative purposes. They include American saffron, black mustard, yellow mustard, blessed thistle, calendula, cannabis, dill, rue, linseed, delphinium, and sesame. Castor oil and stramonium were also raised from Chinese seed. This report particularly deals with the plants first mentioned which we are striving to introduce into China with some knowledge of its needs for proper cultivation.

Germination, Test of Belladonna

Early in March a germination test of belladonna seeds was conducted in the green house. The seeds were divided into lots of 100 each and each lot was treated as indicated in the accompanying table, before sowing in the small pots which were properly labelled, 10 of the 20 pots were filled with sterilized soil and the rest unsterilized. The result is indicated as follows:—

TABLE I. GERMINATION TEST OF BELLADONNA SEEDS IN UNSTERILIZED SOIL

3/7/1925 Procedure	3/24	3/27	3/30	4/4	4/8	4/16	4/20	4/27	Mold
1. Control				1	3	18	30	49	† –
2. Boil 3 min.							1	1	†††
3. H_2O_2–24 hrs.						0	discarded		0
4. 24 hrs. at 5° C.						0			0
5. Conc. H_2SO_4–2 min.	1	2	3	4	2	4	9	9	††
6. ,, ,, –5 ..	1	3	4	10	10	17	29	47	†
7. ,, ,, –10 ..	1	8	8	13	14	19	24	30	0
8. 75% ,, –5 ..						13	28	47	†††
9. ,, ,, –10 ..	1	3	4	5	4	10		11	†
10. ,, ,, –15 ..	2	4	4	7	8	19	26	37	†
TOTAL	6	20	23	40	41	100	148	231	

Table II. Germination Test of Belladonna Seeds in Sterilized Soil

3/7/1925 Procedure	3/24	3/27	3/30	4/4	4/8	4/16	4/20	4/27	Mold
1s Control				3	1	12	28	41	0
2s Boil 3 min.						0		0	†
3s H_2O_2 for 24 hrs.						11	14	32	0
4s 24 hrs. at 5° C.							15	26	†
5s Conc. H_2SO_4 2 min.					4	22	39	50	†††
6s .. .. 5 ..				2		1	5	14	0
7s .. .. 10 ..				1	1	6	25	50	0
8s 75% .. 5 ..				2	3	4	5	5	0
9s .. .. 10 ..	1	1	4	5	8	23	42	65	?
10s .. .. 15 ..	2	7	10	14	14	36	46	50	0
TOTAL	3	8	14	27	30	115	219	333	

Table III. Comparision of Total Germination of Belladonna Seeds in Sterilized and Unsterilized Soil

3/7/1925 Procedure	3/24	3/27	3/30	4/4	4/8	4/16	4/20	4/27
Unsterilized soil	6	20	23	40	41	100	148	231
Sterilized soil	3	8	14	27	31	115	219	333

Results of Germination Test Show:

(1) Seeds without being treated require 4 weeks for germination.

(2) Seeds that are treated with acids germinate 10 days earlier than that which are not treated.

(3) Acid treatment of seeds accelerates but not increases the percentage of germination in the long run.

(4) Boiling the seeds for 3 minutes kill their viability.

(5) The value of treating seeds with H_20_2 is questionable.

(6) The viability of the seeds are about 30%.

(7) Soil sterilization is distinctly valuable, as less mold is developed. The accompanying graph shows the difference in germination between unsterilized and sterilized soil. It will be seen that at the beginning unsterilized soil proves to be better, as it is more loose. 6-7 pots filled with sterilized soil are not affected with green mold; while only 3 of the unsterilized soil are attacked.

(8) Further from the graph, it is to be noted that the percentage of germination increases the most from the 5th-7th week after sowing.

Cultivation of Digitalis and Hyoscyamus

Digitalis

Owing to the great difficulty of counting the digitalis seeds which are of extremely small size, germination test was not conducted. The seeds were merely mixed with fine sand and broadcast on a sowing pan of about one foot in diameter. A handful of sand was then dusted over the seeds, and the soil gently firmed, watered, and kept till the seeds began to germinate.

Henbane

The seeds of hyoscyamus received similar treatment to digitalis.

First Transplanting

As soon as the seedlings of belladonna, digitalis and henbane had 2-4 small leaflets, they were transplanted so that there was only 1 plant in each 3 inch pot. This step is necessary from two angles. In the first place, the seedlings in the seed-pan became too crowded. Secondly, when the young plants became ready to be further transplanted into the field, all that was necesary was to dig a hole in the ground, knock out the tuft of soil with the plant from the small pot by a gentle tap. This process gives practically no disturbance to the roots of the plant which therefore suffers no set back on account of transplanting.

Technique of Transplanting

For the first transplanting from the seed-pan to the small pots, great care must be exercised. A bamboo chip was used to lift up gently the small seedling from the soft and moist soil. This was then placed in the three inch pot, and the soil around the plant was firmed with another bamboo stick.

Hardening

For several weeks, the young plants were kept in the this state until the weather became more settled. They were then taken out during the noon hours on fine days, for hardening.

Preparation of Garden

While the plants were germinating in the hot house, the garden was entirely turned over, the soil sifted, and all large stones removed. This adequately loosened up and aired the ground.

The soil was lacking in organic matter. Its sandy character togther with much lime probably rendered it good for digitalis. The results show how inadequately it met the needs of such solanaceous plants as belladonna and hyoscyamus which need rich nitrogen food. Further trials will call for the use of humus and suitable fertilizer to enrich the soil.

Disease and Loss

During the summer months, some of the plants were attacked by insects. Big black slugs were picked by hand off the root leaves, and finally a spray of 1% lead acetate was applied weekly and very effectually killed off all of the slugs.

Whether due to an excess of rain or the unsuitable nature of the soil, all the belladonna plants died during the month of July when there were very heavy rain storms. Previous to this loss, the leaves of this plant were mostly eaten up by birds. The digitalis along either side of the belladonna partly survived. The henbane did not germinate well and few plants survived the whole season.

Harvest and Wintering

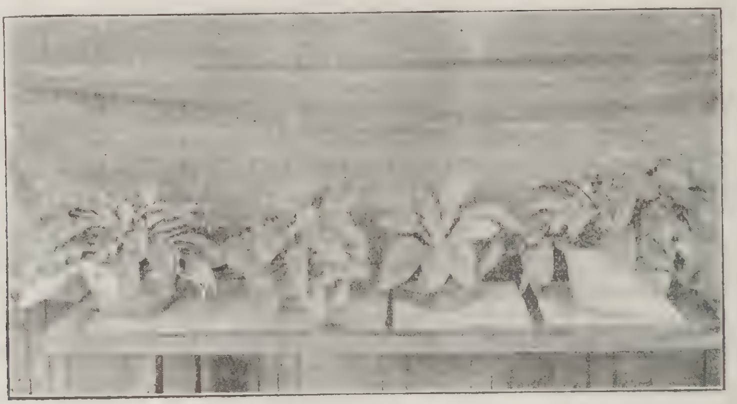
Finally three henbane and fifty-six digitalis lived till the end of the season. We left two digitalis in the field, which are to be covered with earth and straw to pass through the winter. All the rest have been taken up and placed in pots in the cold room.

1. *Digitalis,* fresh leaves-1st year, moisture=76.5%.
2. *Digitalis,* leaves dried in the shade.

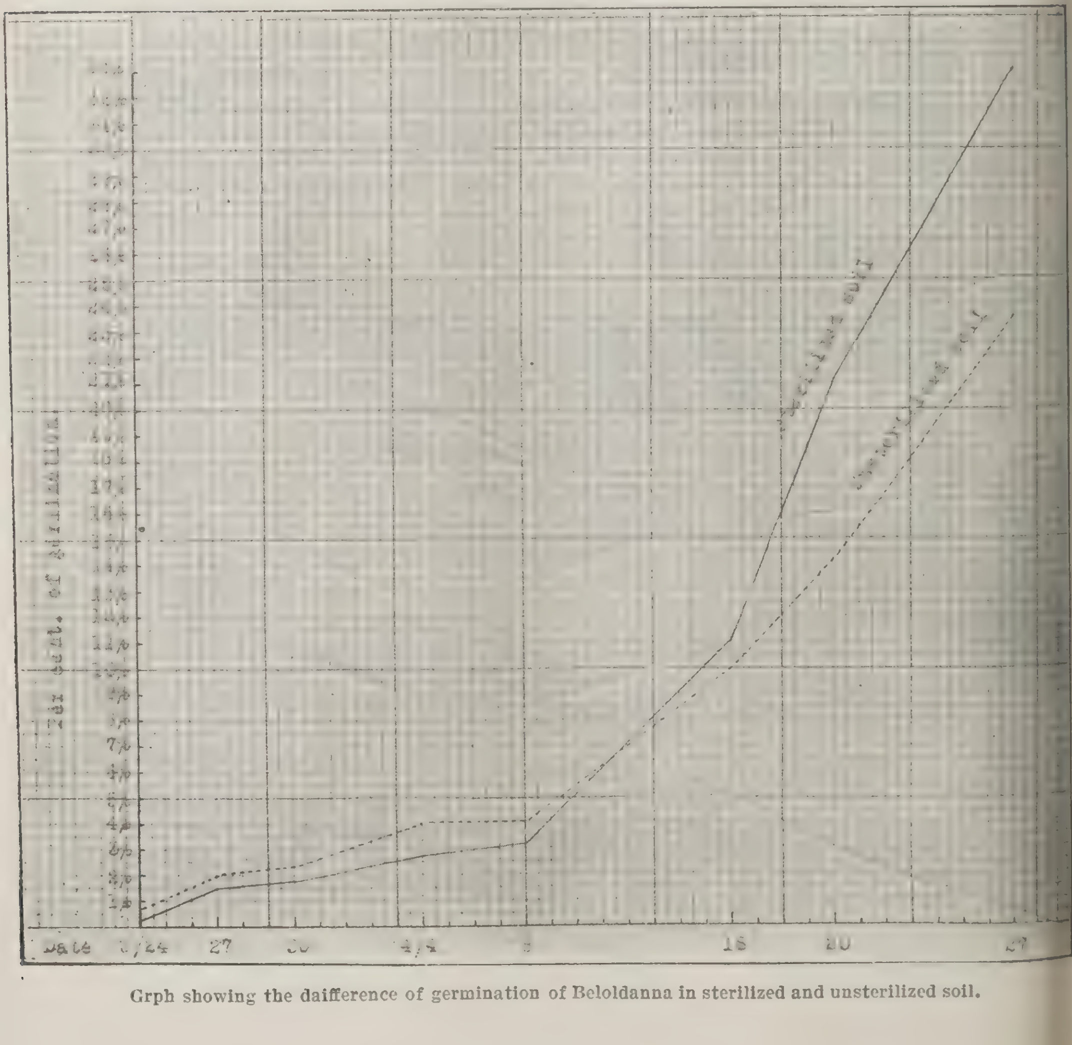
	Moisture	Ash	Ash% of dried leaf
Sample 1.	7.6%	17.47.%	18.91%
„ 2.	5.9%	19.85.%	21.07%
Average	6.75%	0.801%	19.99%

Conclusion

The experiment so far shows that the soil and climate of North China is probably suitable for the cultivation of digitalis. Solanaceous plants do not thrive well on sandy loes soil, not fertilized with a plentiful supply of nitrogen as described in previous reports upon the wild plants.



DIGITALIS PURPUREA
First year plant. Peking, October, 1925.



Grph showing the daifference of germination of Beloldanna in sterilized and unsterilized soil.

SOME CHINESE ROTIFERS

By N. Gist Gee

China Medical Board, Peking.

Foreword

The following list of Chinese Rotifers comprises, so far as we know, all that have been reported from this region up to date.

Surgeon V. Gunson Thorpe of the "Peacock" published an article on the Rotifers of China in the Journal of the Royal Microscopic Society in 1693. Those species recorded from Wuhu are the results of his observations at that time. Those recorded from Soochow have been collected over a period of several years.

For some time we have been collecting specimens of this group in and around Soochow and sending them to Mr. H. K. Harring of Washington, D. C., and he has kindly undertaken to name these as he has been able to find time to do this. We have recently compiled the records of these determinations and Mr. Harring has worked through our list for us giving us the benefit of his expert knowledge of the group.

Altogether 78 species are recorded, 61 of these have been found in Soochow and 29 in Wuhu: 13 have been found in both localities. There are doubtless many additional species that may be found by a careful search in the paddies, ponds and canals.

This is a most fascinating field of study for the microscopist and one that will doubtless yield many species not yet recorded from this part of the world.

ORDER PLOIMA

Family NOTOMMATIDAE

Genus Cephalodella Bory de St. Vincent

Cephalodella catellina (Muller) ... ... Soochow.

(Syn. *Diglena catellina* (Muller)

Ehrenberg, Infusionsth., 1838, p. 444, pl. 55, fig. 3.

Harring and Myers, Trans. Wisconsin Acad. Sci., vol. 21, 1924, p. 465, pl. 27, figs. 3-5.

Cephalodella gibba (Ehrenberg) … … … … Soochow.

(Syn. *Diaschiza gibba* (Ehrenberg))

Dixon-Nuttall and Freeman, Journ. Royal Micr. Soc., 1903, p. 6, pl. 1, fig. 1.

Harring and Myers, Trans. Wisconsin Acad. Sci., vol. 21, 1924, p. 472, pl. 30, figs. 4-6.

Cephalodella gracilis (Ehrenberg)… … … … Soochow.

(Syn. *Diaschiza gracilis* (Ehrenberg))

Dixon-Nuttall and Freeman, Journ. Royal Micr. Soc., 1903, p. 10, pl. 1, fig. 4.

Harring and Myers, Trans. Wisconsin Acad. Sci., vol. 21, 1924, p. 473, pl. 27, fig. 1.

Cephalodella auriculata (Muller) … … … … Soochow.

(Syn. *Diaschiza lacinulata* (Muller))

Dixon-Nuttall and Freeman, Journ. Royal Micr. Soc., 1903, p. 11, pl. 2, fig. 6.

Harring and Myers, Trans. Wisconsin Acad. Sci., vol. 21, 1924, p. 479, pl. 28, fig. 6.

Cephalodella tenuior (Gosse) … … … … … Soochow.

(Syn. *Diaschiza tenuior* Gosse)

Dixon-Nuttall and Freeman, Journ. Royal Micr. Soc., 1903, p. 135, pl. 4, fig. 12.

Harring and Myers, Trans. Wisconsin Acad. Sci., vol. 21, 1924, p. 497, pl. 33, fig. 3.

Cephalodella forficata (Ehrenberg) … … … Soochow.

(Syn. *Diaschiza caeca* (Gosse))

Dixon-Nuttall and Freeman, Journ. Royal Micr. Soc., 1903, p. 134, pl. 4, fig. 11.

Harring and Myers, Trans. Wisconsin Acad. Sci., vol. 21, 1924 p. 499, pl. 33, fig. 7.

Genus SCARIDIUM Ehrenberg

Scaridium longicaudum Ehrenberg … … … Soochow.

Hudson and Gosse, Rotifera, vol. 2, 1886, p. 73, pl. 21, fig. 5.

Genus LINDIA Dujardin

Lindia annecta Harring and Myers … … … Soochow.

Harring and Myers, Trans. Wisconsin Acad. Sci., vol. 20, 1922, p. 622, pl. 54, figs. 6-9.

Lindia pallida Harring and Myers … … … Soochow.

Harring and Myers, Trans. Wisconsin Acad. Sci., vol. 20, 1922, p. 620, pl. 53, figs. 1-4.

Genus Dicranophorus Nitzsch.

Dicranophorus forcipatus (Muller) … … … Soochow.

(Syn. *Diglena forcipata* (Muller))

Hudson and Gosse, Rotifera, vol. 2, 1886, p. 50, pl. 19, fig. 2.

Family EPIPHANIDAE

Genus Epiphanes Ehrenberg

Epiphanes clavulata (Ehrenberg) … … … … Soochow, Wuhu.

(Syn. ? *Notops lotos* (Thorpe)

,, *Notops clavulatus* (Ehrenberg)

Hudson and Gosse, Rotifera, vol. 2, 1886, p. 12, pl. 15, fig. 3.

Epiphanes senta (Muller) … … … … … Soochow.

(Syn. *Hydatina senta* (Muller))

Hudson and Gosse, Rotifera, vol. 2, 1886, p. 9, pl. 14, fig. 1.

Family MICROCODONIDAE

Genus Mikrocodides Bergendal

Mikrocodides chlaena (Gosse) … … … … Wuhu.

(Syn. *Rhinops orbiculodiscus* Thorpe)

,, *Microcodides chlaena* (Gosse))

Weber, Rev. Suisse Zool., vol. 5, 1898, p. 369, pl. 16, figs. 5, 6.

Thorpe, Journ. Royal Micr. Soc., 1891, p. 304, pl. 7, fig. 4.

Family BRACHIONIDAE

Genus Brachionus Pallas

Brachionus angularis Gosse … … … … Soochow.

Hudson and Gosse, Rotifera, vol. 2, 1886, p. 120, pl. 27, fig. 4.

Brachionus capsuliflorus Pallas ... ... Soochow, Wuhu.
(Syn. *Brachionus bakeri* Muller)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 120, pl. 27, fig. 8.

Brachionus calyciflorus Pallas ... ... Soochow.
(Syn. *Brachionus pala* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 117, pl. 27, fig. 3.

Brachionus falcatus Zacharias ... ... Yangtse River.
Weber, Zool. Jahrb., Syst., vol. 24, 1906, p. 213, figs. H-O.

Brachionus patulus Muller ... ... Soochow, Wuhu.
(Syn. *Brachionus militaris* Ehrenberg)
Hudson and Gosse, Rotifera, Suppl., 1889, p. 52, pl. 34, fig. 23.

Brachionus urceus (Linne) ... ... Soochow, Wuhu.
(Syn. *Brachionus rubens* Ehrenberg)
Rousselet, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1907, p. 151, pl. 12, figs. 9-11.

Genus Platyias Harring

Platyias quadricornis (Ehrenberg) ... ... Soochow, Wuhu.
(Syn. *Noteus quadricornis* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 121, pl. 28, fig. 5.

Genus Anuraeopsis Lauterborn

Anuraeopsis fissa (Gosse) ... ... Wuhu.
(Syn. *Anuraea hypelasma* Gosse)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 123, pl. 29, fig. 6.

Family EUCHLANIDAE

Genus Euchlanis Ehrenberg

Euchlanis dilatata Ehrenberg ... ... Soochow.
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 90, pl. 23, fig. 5.

Euchlanis deflexa Gosse ... ... Soochow.

Hudson and Gosse, Rotifera, vol. 2, 1886, p. 92, pl. 24, fig. 1.

Genus LECANE Nitzsch.

Lecane arcula Harring … … … … … … Soochow.

Harring, Proc. U. S. Nat. Mus., vol. 47, 1914, p. 539, pl. 19, figs. 4-6.

Lecane inermis (Bryce) … … … … … … Soochow.

(Syn. *Distyla inermis* Bryce,
,, *Lecane amorpha* Harring)

Harring, Proc. U. S. Nat. Mus., vol. 47, 1914, p. 544, pl. 23, figs. 1, 2.

Lecane flexilis (Gosse) … … … … … … Soochow.

(Syn. *Distyla flexilis* Gosse)

Harring, Proc. U. S. Nat. Mus., vol. 47, 1914, p. 538, pl. 19, figs. 1-3.

Lecane luna (Muller) … … … … … … Soochow.

(Syn. *Cathypna luna* (Muller))

Hudson and Gosse, Rotifera, vol. 2, 1886, p. 94, pl. 24, fig. 4.

Lecane ludwigii (Eckstein) … … … … … Soochow.

(Syn. *Distyla ludwigii* Eckstein)

Jennings, Bul. U. S. Fish Comm., vol. 19, 1900, p. 92, pl. 20, fig. 32.

Lecane ohioensis (Herrick) … … … … … Soochow.

(Syn. *Distyla ohioensis* Herrick)

Jennings, Bul. U. S. Fish Comm., vol. 19, 1900, p. 91, pl. 20, fig. 30.

Lecane ungulata (Gosse)… … … … … … Soochow.

(Syn. *Cathypa ungulata* Gosse)

Jennings, Bul. U. S. Fish Comm., vol. 19, 1900, p. 91, pl. 19, figs. 26, 27.

Genus MONOSTYLA Ehrenberg

Monostyla closterocerca Schmarda … … … Soochow.

Murray. Journ. Royal Micr. Soc., 1913, p. 357, pl. 15, fig. 39.

Monostyla hamata Stokes … … … … … Soochow.

Murray, Journ. Royal Micr. Soc., 1913, p. 359, pl. 15, fig. 41.

Monostyla bulla Gosse ... ... Soochow.

Murray, Journ. Royal Micr. Soc., 1913, p. 353, pl. 15, fig. 33.

Monostyla obtusa Murray ... ... Soochow.

Murray, Journ. Royal Micr. Soc., 1913, p. 357, pl. 15, fig. 37.

Monostyla pyriformis Daday ... ... Soochow.

(Syn. *Monostyla truncata* Turner)

Murray, Journ. Royal Micr. Soc., 1913, p. 358, pl. 15, fig. 38.

Monostyla quadridentata Ehrenberg ... ... Soochow.

Murray, Journ. Royal Micr. Soc., 1913, p. 354, pl. 15, fig. 34.

Monostyla stenroosi Meissner ... ... Soochow.

(Syn. *Monostyla bicornis* Stenroos)

Murray, Journ. Royal Micr. Soc., 1913, p. 355, pl. 15, fig. 35.

Genus Lepadella Bory de St. Vincent

Lepadella apsida Harring ... ... Soochow.

Harring, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 536, pl. 89, figs. 1-3.

Lepadella ovalis (Muller) ... ... Soochow.

(Syn. *Metopidia solidus* Gosse)

Harring, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 537, pl. 89, figs. 4-10.

Lepadella patella (Muller) ... ... Soochow.

(Syn. *Metopidia lepadella* Ehrenberg)

Harring, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 539, pl. 90, figs. 1-12.

Lepadella acuminata (Ehrenberg) ... ... Soochow.

(Syn. *Metopidia acuminata* Ehrenberg)

Harring, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 546, pl. 92, figs. 4-8.

Lepadella triptera Ehrenberg ... ... Soochow.

(Syn. *Metopidia triptera* (Ehrenberg))

Harring, Proc. U. S. Nat. Mus., vol. 51, 1916, p. 560, pl. 95, figs. 1-4.

Genus COLURELLA Bory de St. Vincent

Colurella adriatica Ehrenberg … … … … Wuhu.
(Syn. *Colurus caudatus* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 104, pl. 26, fig. 6.

Colurella bicuspidata (Ehrenberg) … … … Soochow.
(Syn. *Colurus uncinatus* Ehrenberg)
Von Hofsten, Arkiv Zool., vol. 6, No. 1, 1909, p. 81, fig. 21.

Colurella obtusa (Gosse) … … … … … … Soochow.
(Syn. *Colurus obtusus* Gosse)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 103, pl. 26, fig. 3.

Genus SQUATINELLA Bory de St. Vincent

Squatinella mutica (Ehrenberg) … … … … Soochow.
(Syn. *Stephanops muticus* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 75, pl. 21, fig. 6.

Genus MYTILINA Bory de St. Vincent

Mytilina ventralis (Ehrenberg) … … … … Soochow.
(Syn. *Salpina ventralis* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 85, Suppl., 1889, p. 38, pl. 33, fig. 29.

Genus MACROCHAETUS Perty

Macrochaetus serica Thorpe … … … … Wuhu.
(Syn. *Dinocharis serica* Thorpe)
Thorpe, Journ. Royal Micr. Soc., 1893, p. 152, pl. 2, fig. 4.

Family TRICHOCERCIDAE

Genus TRICHOCERCA Lamarck

Trichocerca cristata Harring … … … … Soochow.
(Syn. *Rattulus carinatus* (Ehrenberg))
Jennings, Bul. U. S. Fish Comm., vol. 22, 1903, p. 332, pl. 11, figs. 95-97.

Trichocerca longiseta (Schrank) ... ... Soochow.
(Syn. *Rattulus longiseta* (Schrank))
Jennings, Bul. U. S. Fish Comm., vol. 22, 1903, p. 328, pl. 8, figs. 67-72.

Trichocerca rattus (Muller) ... ... Soochow.
(Syn. *Rattulus rattus* (Muller))
Jennings, Bul. U. S. Fish Comm., vol. 22, 1903, p. 333, pl. 11, figs. 100,101.

Genus DIURELLA Bory de St. Vincent

Diurella brachyura (Gosse) ... ... Soochow.
Jennings, Bul. U. S. Fish Comm., vol. 22. 1903, p. 317, pl. 3, figs 35,36.

Diurella tenuior (Gosse)... ... ... Soochow.
Jennings, Bul. U. S. Fish Comm., vol. 22, 1903, p. 308, pl. 1, figs. 7-10.

Family GASTROPODIDAE

Genus ASCOMORPHA Perty

Ascomorpha volvocicola (Plate) ... ... Soochow.
(Syn. *Proales parasita* (Ehrenberg))
Voigt, Forschungsber. Plon, vol. 11, 1904, p. 43, pl. 3, fig. 19.

Family SYNCHAETIDAE

Genus POLYARTHRA Ehrenberg

Polyarthra trigla Ehrenberg ... ... Soochow, Wuhu.
(Syn. *Polyarthra platyptera* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 3, pl. 13, fig. 5.

Family FILINIIDAE

Genus FILINIA Bory de St. Vincent

Filinia longiseta (Ehrenberg) ... ... Wuhu.
(Syn. *Triarthra longiseta* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 6, pl. 13, fig. 6.

Genus PEDALIA Barrois

Pedalia mira (Hudson)... ... ... Soochow, Wuhu.

(Syn. *Pedalion mirum* (Hudson))
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 132, pl. 30, fig. 1.

Family ASPLANCHNIDAE

Genus ASPLANCHNA Gosse

Asplanchna brightwellii Gosse ... ... Soochow.
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 122, pl. 12, fig. 1.

Genus ASPLANCHNOPUS De Guerne

Asplanchnopus multiceps (Schrank) ... ... Wuhu.
(Syn. *Asplanchnopus myrmeleo* (Ehrenberg))
Hudson and Gosse, Rotifera, Suppl., 1889, p. 15, pl. 32, fig. 13.

Family TESTUDINELLIDAE

Genus TESTUDINELLA Bory de St. Vincent

Testudinella patina (Hermann) ... ... Soochow, Wuhu.
(Syn. *Pterodina patina* (Hermann))
Hudson and Gosse, Rotifera, vol. 2, 1886, p. 112, pl. 26, fig. 11.

Family TROCHOSPHAERIDAE

Genus TROCHOSPHAERA Semper

Trochosphaera solstitialis Thorpe ... ... Wuhu.
Thorpe, Journ. Royal Micr. Soc., 1893, p. 147, pl. 2, fig. 2.

ORDER FLOSCULARIACEA

Family FLOSCULARIIDAE

Genus FLOSCULARIA Cuvier

Floscularia ringens (Linne) ... ... Soochow, Wuhu.
(Syn. *Melicerta ringens* (Linne))
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 70, pl. 5, fig. 1.

Genus OCTOTROCHA Thorpe

Octotrocha speciosa Thorpe ... ... Wuhu.
Thorpe, Journ. Royal Micr. Soc., 1893, p. 146, pl. 2, fig. 1.

Genus LIMNIAS Schrank

Limnias ceratophylli Schrank ... ... Wuhu.
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 75, pl. 6, fig. 1.

Limnias melicerta (Weisse) ... ... Wuhu.
(Syn. *Limnias annulatus* Bailey)
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 77, pl. 6, fig. 2.

Genus SINANTHERINA Bory de St. Vincent

Sinantherina socialis (Linne) ... ... Soochow.
(Syn. *Megalotrocha alboflavicans* (Ehrenberg))
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 87, pl. 8, fig. 2.

Sinantherina procera (Thorpe) ... ... Soochow, Wuhu.
(Syn. *Megalotrocha procera* Thorpe)
Thorpe, Journ. Royal Micr. Soc., 1893, p. 150, pl. 3, fig. 5.

Sinantherina semibullata (Thorpe) ... ... Soochow, Wuhu.
(Syn. *Megalotrocha semibullata* (Thorpe))
Thorpe, Journ. Royal Micr. Soc., 1889, p. 614, pl. 12.

Sinantherina spinosa (Thorpe) ... ... Wuhu.
(Syn. *Megalotrocha spinosa* Thorpe)
Thorpe, Journ. Royal Micr. Soc., 1893, p. 151, pl. 3, fig. 6.

Genus LACINULARA Schweigger

Lacinularia megalotrocha Thorpe ... ... Wuhu.
Thorpe, Journ. Royal Micr. Soc., 1893, p. 149, pl. 2, fig. 3.

Lacinularia racemovata Thorpe ... ... Wuhu.
(Syn. *Lacinularia elliptica* Shephard)
Thorpe, Journ. Royal Micr. Soc., 1893, p. 150, pl. 3, fig. 7.

Family COLLOTHECIDAE

Genus Collotheca Harring

Collotheca campanulata (Dobie) ... ... Wuhu.
(Syn. *Floscularia campanulata* Dobie)
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 52, pl. 1, fig. 1.

ORDER BDELLOIDA

Family PHILODINIDAE

Genus Rotaria Scopoli

Rotaria macroceros (Gosse) ... ... Wuhu.
(Syn. *Rotifer macroceros* Gosse)
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 105, pl. 10, fig. 5.

Rotaria neptunia (Ehrenberg) ... ... Soochow, Wuhu.
(Syn. *Actinurus neptunius* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 108, pl. 10, fig. 6.

Rotaria rotatoria (Pallas) ... ... Soochow, Wuhu.
(Syn. *Rotifer vulgaris* Schrank)
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 104, pl. 10, fig. 2.

Rotaria tardigrada (Ehrenberg) ... ... Wuhu.
(Syn. *Rotifer tardus* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 105, pl. 10, fig. 1.

Genus Dissotrocha Bryce

Dissotrocha aculeata (Ehrenberg) ... ... Soochow.
(Syn. *Philodina aculeata* Ehrenberg)
Hudson and Gosse, Rotifera, vol. 1, 1886, p. 101, pl. 9, fig. 5.

Dissotrocha macrostyla (Ehrenberg) ... ... Soochow.
(Syn. *Philodina macrostyla* Ehrenberg)
Hudson and Gosse, Rotifera, Suppl., 1889, p. 7, pl. 32, fig. 6.

ON SOME FRESH-WATER ALGAE, COLLECTED BY DR. H H. CHUNG IN AMOY, CHINA

By B. W. Skvortzow
Harbin, Manchuria.

The samples of freshwater Algae dealt with in the present note were kindly collected by Dr. H. H. Chung, Prof. of Botany of the University of Amoy in the winter of 1924.

When examined this collection was found to contain the following species (exclusive of Desmids and Diatoms).

Scenedesmus acutiformis Schröder.

Coenobia of 4 cells arranged in a linear series. Cells fusiform, with acute apices.

Scenedesmus bijugatus (Turpin) Kütz. *B. alternans* (Reinsch) Hansgirg and *L. seriatus* Chodat.

Cells ovoid, with broadly rounded ends.

Scenedesmus opolinensis Richter var. *carinatus* Lemm. Coenobia flat, of 4 cells. Terminal cells with a long spine at each pole.

Scenedesmus incrassatulus Bohlin. Fig. 3, 4.

Coenobia flat, of 2-4 cells. Terminal cells fusiform.

Scenedesmus obliquus (Turpin) Kütz.

Coenobia of 2-4 cells. Terminal cells slighty concave, straight.

Scenedesmus quadricauda (Turp.) Breb.

Coenobia flat, of 2-4 cells. Terminal cells with spines.

Scenedesmus aluminatus (Lagerb.) Chodat.

Coenobia curved, of 4 cells. The cells are fusiform and pointed.

Scenedesmus serratus (Corda) Bohlin.

Coenobia flat, of 2-4 cells. Entire surface of cells covered with minute spines.

Ankistrodesmus falcatus (Corda) Ralf's var. *acicularis* (A. Braun) G. S. West and var. *stipitatus* (Chodat) Lemm.

Ankistrodesmus spiralis (Turner) Lemm.

Coelastrum scabrum Reinsch.

Coenobia spheric, with 6 cells. Cells with small horns.

Coelastrum microporum Naegeli.

Coenobia ovoid, with 8-16 cells. Cells spherical.

Tetraedron minimum (Al. Braun) Hansg. var. *apiculatum* Reinsch.

Cells small, flattened, front view square with concave sides.

Dictyospaerium pulchellum Wood.

Oocystis solitaria Wittrock.

Oocystis gigas Archer var. *minor* West forma.

A form with cells 25.9 mikr. in length, 22 mikr. in breadth.

Kento-sphaera tacciolae Borzi var. *minor* nov. var. Fig. 5.

Cell spheric, 11.1 mikr. in diameter. Cell wall thick.

Kirchneriella subsolitaria G. S. West. Fig. 2.

Cell small with curved apices.

Kirchneriella sinensis sp. nov. Fig. 6.

Cells elongate-cylindrical, with rounded ends and more or less curved, solitary. Length of cells 5-5.7 mikr.; breadth 0.8-1 mikr. Chloroplast single, without a pyrenoid.

Keratococcus angulus Pascher.

Ankistrodesmus convolutus Corda. Fig. 1.

Cells 3.7-5.7 mikr. in length; 0.8-1 mikr. in breadth, solitary.

Gloeotila protogenita Kütz.

Gloeotila calderia Kütz.

Gloeotila mucosa Kütz.

Microspora tumidula Hazen.

Ulotrix variabilis Kütz.

Ulotrix tenerrima Kütz.

Ulotrix zonata Kütz.

Binuclearia tatrana Wittrock.

Microthamnion strictissimum Rabenh.

Palmella hyalina Rabenh.

Chlorococcum infusionum (Schrank) Meneghini.

Gloeocystis ampla Kütz.

Hydrodictyon reticulatum (L.) Lagerh.

Sphenomonas teres (Stein) Klebs.

Menoidium tremulum Skvortzow in Farblose Euglenaceen aus Nordmandschurei (Archiv f. Protistenkunde, 48 Band. S. 183. Tex. Fig. A, 9.)

Found only in Manchuria.

Peranema trichophorum (Ehrenb.) Stein.

Trachelomonas volvocina Ehrenb.

Trachelomonas hispida (Perty) Stein and var. *punctata* Lemm.

Trachelomonas Raciborskii Wolosz. var. *punctata* Skvortzow in "On new Flagellata from Manchuria" (Jour. Asiat. Sc. Shanghai Vol. L. 1919, Pl. 1. Fig. 15).

Up to the present found only in Manchuria.

Trachelomonas Kelloggii Skvortz.var. *Chung** Skvortz. Fig. 8 (in Die Euglenaceengattung Trachelomonas Ehrenb. Eine system-ubersicht. S. 30. Taf. VII, fig. 30. Harbin, 1925).

Cell oval, brown, dotted and covered with thick spines.

Length 25.5 to 29.6 mikr.; Breadth 20.5 to 25 mikr. The aperture for the flagella is wide, 2.5-3.7 mikr. in breadth.

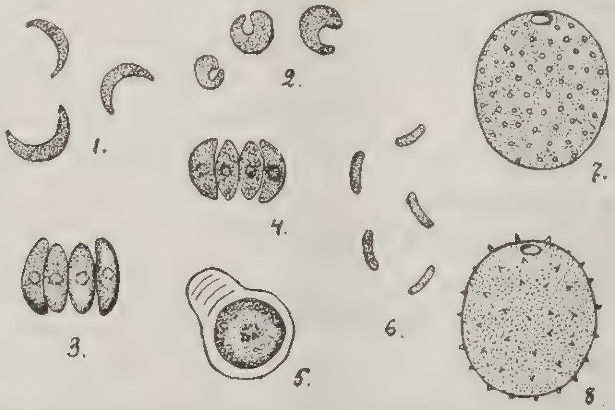
Found only in Amoy.

Trachelomonas Kelloggii Skvortz var. *bipunctata* Skvortz. Fig. 7, in Die Euglenaceengattung Trachelomonas Ehrenb. Eine systematische ubersicht. S. 30. Taf. II. Fig. 38.

Cell oval, brown, dotted and covered with circular pits.

Length 23.8 mikr.; Breadth 21.2 mikr. Cilia aperture is 3.4 mikr. in breadth.

Found only in Amoy.



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*Named in honor of Prof. H. H. Chung, Amoy.

CHINESE FRESH-WATER SPONGES

Some Historical Notes.

N. Gist Gee

China Medical Board, Peking.

Lemmermann in writing his article "Das Plankton des Yangtse-Kiang (China)" for the Arch. Hydrobiol. [Bd. 2, pg. 534-544,] states that he found in dredgings from the river bottom gemmules of a fresh-water sponge which he called *Euspongilla lacutris* var. *lieberkuhnii*. Noll. This variely is now considered a synonym of *Spongilla (Euspongilla) lacustris*.

A second record of a fresh water sponge from China is that in the Proceedings of the U. S. National Museum vol. 38, No. 1,737, published in June 1910. It was later figured in the Memoirs of the Asiatic Society of Bengal Vol. VI, pg. 204. Dr. Annandale states in this note that so far as he is aware no fresh-water sponge has as yet been described from China, though he had the Yunnan specimens in hand at that time. This specimen described in this case was one collected by the writer several years previous to 1910 in Soochow, Kiangsu, and sent along with other materials to the U. S. National Museum. The specimen was kept there for some years and was finally sent to Dr. Annandale, Director of the Zoological Survey of India in Calcutta, to be worked up. He found it to be a new species and named it "*Spongilla sinensis*."

Spongilla sinensis, Annandale.—This specimen was first collected from a wooden pile on the edge of the large canal just east of the city wall of Soochow. After finding this first specimen we afterwards discovered that sponges were very abundant in that same vicinty and sent large numbers of specimens on direct to Dr. Annandale for identification. He identified some of these for us but during the years from 1910 to 1916 he did not publish any further descriptions of China fres-hwater sponges. The U. S. National Museum has the type of *Spongilla sinensis* and we have a small co-type in our collection.

The next record that I can find is the description by Dr. Annandale of three species of sponges which were collected by Mr. Coggin Brown in the western district of Yunnan Province. These specimens were collected in 1909-10 and were described in September of the year 1910 in the Records of the Indian Museum, Vol. V, Part II, No. 21. We give a few notes on each of those forms.

1. *Spongilla lacustris*, auct.—This specimen was taken from a lake full of weeds at an elevation of 5,000 to 6,000 feet at Mong Pan, Yunnan. Dr. Annandale first called this sponge *Spongilla proliferens* but later decided that it was the same as *Spongilla lacustris*. The Yunnan specimens of this species are preserved in the collections of the Indian

Museum. This is a very cosmopolitan species and good descriptions of it are available in almost all literature on fresh-water sponges. A number of variations from the type are also recorded. The location of the type of this species is unknown.

2. *Spongilla clementis,* Annandale.—This specimen was collected in March 1910 at the south outlet of Lake Tali-fu (Erh-hai), Yunnan, at an elevation of 6,900 feet. It was first described as a new species and was named *Spongilla yunnanensis*, but after further study and more careful comparison with other related forms, Dr. Annandale came to the conclusion that this form was identical with *Spongilla clementis* which he had described in the Proceedings of the U. S. National Museum, Vol. 36, 1909, the year before from Lake Lanao in the Philippines. There is an illustration of this species with this description in that volume of the Proceedings. The type of this species is preserved in the U. S. National Museum. The Yunnan specimens are in the Indian Museum. A small piece of the Yunnan material is in our collection.

3. *Nudospongilla coggini* (Annandale).—This specimen was taken, together with the *Spongilla clementis* from Lake Tali-fu, Yunnan. This form was called *Spongilla coggini* by Dr. Annandale in his original description of it but later the generic name was changed by him to *Nudospongilla* to indicate that the gemmules were without a covering of gemmule spicules. Drawings of the skeleton spicules are to be found with the original description in Records of the Indian Museum referred to above. The specific name of the sponge was given to it in honor of the collector. The type is kept in the Indian Museum in Calcutta, India. We have a minute co-type of this species in our collection.

In December of 1915, Dr. Annandale paid a visit to the region around the city of Soochow and spent two or three days on a house-boat with Dr. Arthur Stanley in and around the T'ai Hu or Great Lake which is only a short distance from the city. Dr. Annandale found several small specimens of fresh-water sponges growing on the surfaces of rocks or on water plants. Immediately upon his return to Shanghai, he examined these and found three new species which he described and these were published in the Journal of the North China Branch of the Royal Asiatic Society, Vol. XLVII, 1916. He deposited the types of all three of these species in the Indian Museum and also left co-types in the Shanghai Museum of the Royal Asiatic Society.

1. *Spongilla micron*, Annandale.—This small sponge was first found growing in little patches on the submerged leaves of *Vallisneria spiralis*, or eel-grass, which is very abundant in the shallow lakes and canals of that region. It was found growing on this grass and on other water plants at the mouth of the Moo Too Creek and at Tong Dong Ding in the lake. The author stated that he found the parts of this sponge unusually small and that for this reason he called it "micron." The first published measurements were wrong owing to a confusion of the spicules of two species and the spicules are not nearly so small as they

were at first thought to be. This species was later figured and the descriptions corrected in the Memoirs of the Asiatic Society of Bengal, Vol. VII, Part IV, 1918. A small co-type of this species is in our collection.

2. *Spongilla stanleyi*, Annandale.—This sponge was first found forming lichenoid patches less than one mm. thick on the lower surfaces of stones and of shells of certain molluscs (*Vivipara*) near the village landing stage at Si Dong Ding an island in the T'ai Hu. While the type of this species is also preserved in the Indian Museum, yet a co-type was placed in the Shanghai Museum of the North China Branch of the Royal Asiatic Society, and is still there. We have a slide made from the Shanghai co-type. We failed to find the co-types of the other two of these three species though Dr. Annandale states that he gave them to the Museum. This sponge has been found in Soochow in larger and thicker colonies than the one in the Museum in Shanghai. The sponge was named in honor of Dr. Stanley who accompanied Dr. Annandale on this trip. The spicules of this species are illustrated on page 204 of the sixth volume of the Memoirs of the Asiatic Society of Bengal, 1918.

3. *Spongilla conifera*, Annandale.—This sponge was found growing under similar conditions and associated with *Spongilla micron* on the leaves of *Vallisneria*. We have also found this sponge in the smaller lakes to the east of the city of Soochow. It is often easily found after the farmers have cut the *Vallisneria* for fertilizing their fields and bits of the brittle grass are left floating on the water's surface. A careful inspection of the part of the lake where the grass was cut or of the boat containing this grass will often reveal bits of the sponge covered grass. We have found bits of it several centimeters long and thick enough to bind two leaves of grass together, though the specimens are always small. The gemmules of this sponge have a very unusual conical shape hence the name "conifera." The gemmules have been illustrated on Plate IX of the Memoirs of the Asiatic Society of Bengal, Volume VI, 1918. We have a small co-type of this species in our collection.

After we received the publications describing these forms and the letters from Dr. Annandale giving us determinations of a number of sponges which we had sent him from time to time after our return from furlough in 1916, we went to work to study our locality with greater care and succeeded in collecting large numbers of specimens, most of them coming from one small canal running east from the city of Soochow and flowing into the lake, Waung Tien Daung. Bits of many of these specimens were sent to Dr. Annandale and in 1918 he published in the Memoirs of the Asiatic Society of Bengal, Volume VI, Part IV, his "Zoological Results of a Tour in the Far East." In part II of this paper he enumerated the following ten species as being found in China from Kiangsu province; six out of these ten were known only from that province. The list is as follows:—

1. Spongilla micron, Annandale
2. ,, conifera, ,,
3. ,, stanleyi, ,,

4. ,, sinensis, Annandale
5. ,, geei, ,,
6. ,, semispongilla, (Annandale)
7. Trochospongilla sol, Annandale
8. ,, latouchiana, Annandale
9. Ephydatia bogorensis, Weber
10. ,, meyeni, (Carter)

We have referred already to the description of the first four of these ten species. Now we wish to comment further on the other six.

5. *Spongilla geei*, Annandale.—This sponge is denser and more massive than any of those already described from Kiangsu and it is very common, seeming to prefer to grow on the rock bunding of the canal banks where there is a flowing motion to the water in the canal. The sponge has also been found in other places in the Yangtse Valley in both Kiangsu and Chekiang Provinces. The original description of this species is in this paper referred to above and it was also figured there. The type of this species is preserved in the Indian Museum and we have a small co-type of it.

6. *Spongilla semispongilla*, (Annandale).—This species was originally described and figured from Lake Biwa in Japan in the Journal of the College of Science, Imperial University, Tokyo, Volume XXXIX, Article I, August 1916, as *Ephydatia semispongilla*. Later Dr. Annandale changed this to *Spongilla semispongilla*. In this species, a number of specimens of which we have since found in Soochow, the gemmule spicules are somewhat intermediate between the genera *Spongilla* and *Ephydatia* and for this reason the name "*semispongilla*" was given to the species when it was first described. The type of the species is in the Indian Museum. We have a small co-type.

7. *Trochospongilla latouchiana*, Annandale.—The original description of this species is to be found in The Journal and Proceedings, Asiatic Society of Bengal (New Series), Volume III, No. 1, 1907 in Notes on the Fresh-Water Sponges of India, No. IX. This species is one of our most common ones and has been collected in Nanking, Soochow, Kashing and other places in Kiangsu and Chekiang. Dr. Annandale first reported the materials sent him from that region as being this species and later upon examination of a larger number of specimens pointed out the fact that the differences between the Indian species and the one from China were so marked that he thought the China form entitled to a varietal name (Records of the Indian Museum, Volume XVI, Part VII, December 1919) and he called it *Trochospongilla latouchiana* var. *sinensis*. The proportions of the gemmule spicules differ somewhat but the most marked difference is that the shaft in the variety *sinensis* is markedly longer than in the type species. Both the type species and the variety have now been collected in Nanking, Soochow and Kashing and also in

other places. These sponges often form very thin sheets on stone or on the wooden piles driven in the water to support the walls which border the canals. Again they may form much thicker growths as much as 1 or 2 cm. in thickness. The minute white gemmules crowd the whole sponge almost and the velvety surface enables one to pick them easily from the Spongillas and Ephydatias. The types of both of these species *T. latouchiana* and *T. latouchiana* var. *sinensis*, are in the Indian Museum and we have a co-type of each one.

8. *Trochospongilla sol*, Annandale.—This little sponge was found as very minute patches on the surface of a stone and was described and figured for the first time in the article in the Memoirs of the Asiatic Society of Bengal referred to above. It seems to be not only very small but also very rare though since the first description of it we have found several times the very characteristic gemmule spicules with their rotules clearly marked with radii running from the center to their circumference. In two or three of our Soochow slides we have found scattered gemmule spicules of this rayed type. In one specimen sent us from Nanking, but marked from Amoy, we have also found numerous gemmule spicules of *T. sol.* Thus it would appear that this form occurs in a number of different localities. Through the courtesy of the Director of the Zoological Survey of India we were allowed to make some slides from the type of this sponge which is preserved in the Indian Museum.

9. *Ephydatia bogorensis*, Weber.—This species was first described and figured from the Dutch East Indies by Dr. Max Weber in 1890 in Zoologische Ergebnisse einer reise in Niederlandisch Ost-Indian Heft I, Leiden. The specimen from Soochow identified as *E. bogorensis* by Dr. Annandale was one of a lot of which we did not, unfortunately, keep a duplicate. While we have examined carefully large numbers of *Ephydatias* from the Soochow region since that time yet we have never succeeded in again finding this species. The Indian Museum authorities have kindly sent me bits of their Soochow material labeled *E. bogorensis* and the indentification is correct, yet it is strange that we have not found it again.

10. *Ephydatia meyeni* (Carter).—Carter described and figured this species back in 1849 in the Journal of the Bombay Asiatic Society, III, and Annals of Natural History (2) IV; he called it *Spongilla meyeni* at that time. This form, like the *E. bogorensis*, seems to be very rare around Soochow for we have had great difficulty in locating even one specimen of it since these specimens were determined for us by Dr. Annandale.

During Dr. Annandale's life time we sent our materials to him for identification but since his sad death early in 1925 we have undertaken to work on the China sponges in order that we might get together here in China a representative collection of fresh-water sponges from all parts of the country. With this in view we have undertaken to get together a list of all the species known up to date and to compile from the various scattered sources the available information concerning the China species.

It is our hope that these illustrated descriptions will stimulate an interest among amateur naturalists and enable us to secure sponges from all over the country from these collectors.

In the February (1925) number of The China Journal of Science and Arts, Shanghai we listed the fourteen species indicated by an asterisk in the list given below and since that time several numbers of the Journal have contained illustrated descriptions of the species enumerated and the descriptions of the others of this list of 14 species are now in the hands of the editor for publication. These will doubtless be published one at a time in subsequent issues of the Journal.

In carefully working over our collections to date we have found several new sponges, some altogether new to science and others which are already known but are recorded for the first time from China. This extended list was published in the Journal of the North China Branch of The Royal Asiatic Society for 1926 and we give below the list as it stood at that time, July, 1926.

Genus SPONGILLA

Sub-genus EUSPONGILLA

*1.	*Spongilla lacustris*, auct.	Yunnan
*2.	,, *micron*, Annandale	Kiangsu
*3.	,, *semispongilla*, (Annandale)	,,

Sub-genus EUNAPIUS

*4.	*Spongilla conifera*, Annandale	Kiangsu
*5.	,, *geei*, ,,	,,
6.	,, *fragilis*, Leidy	,,
*7.	,, *carteri*, var. *melli* Arndt.	Kwangtung & Fukien

Sub-genus STRATOSPONGILLA

*8.	*Spongilla clementis*, Annandale	Yunnan
*9.	,, *sinensis*, ,,	Kiangsu
*10.	,, *stanleyi*, ,,	,,

Genus TROCHOSPONGILLA

11.	*Trochospongilla latouchiana*, Annandale	Kiangsu & Chekiang
	,, var. *sinensis*, Annandale	
*12.	,,	Kiangsu & Chekiang
*13.	,, *sol*, Annandale	Kiangsu & Fukien
14.	,, *horrida* var. *ningpoensis* Gee	Chekiang
15.	,, *tunghuensis*, Gee	,,

Genus EPHYDATIA

*16. *Ephydatia meyeni* (Carter) ... ... Kiangsu

*17. ,, *bogorensis*, Weber ... ... ,,

18. ,, *fluviatilis*, auct. ... ... ,, Chekiang, Chihli, Shantung

19. ,, ,, var. *chui*, Gee ... ... Chekiang

Genus NUDOSPONGILLA

*20. *Nudospongilla coggini* (Annandale) ... ... Yunnan

We have now in hand a number of additional specimens of sponges from China which will doubtless prove at least to be new records and we hope to be able to work these out at an early date.

It will be noted that we have made six additions to the list as first given by us in the China Journal of Science and Arts in February, 1925, and that out of that number three are new records for China and three are new forms. We wish to comment briefly on these additions:—

1. *Spongilla fragilis*, Leidy.—Dr. J. Leidy described this species from America in the Proceedings of the Academy of Natural Sciences, Philadelphia, in 1851. We have found it in two or three places in Kiangsu province and in my Nanking specimens it forms rather small, more or less circular blackish colonies often on top of the very thin films of *Trochospongilla* which were found in such abundance in one locality there. It has also been found in rather larger and thicker colonies both in Nanking and in Soochow.

2. *Spongilla carteri* var. *melli*, Arndt.—Dr. W. Arndt described this new variety of sponge in March 1923, in Zoologiseban Anzeiger, Bd. LVI, Nr. 3/4, Vom. 6, from specimens collected by Mr. Mell from the vicinity of Canton. This was the first record of a fresh water sponge from that region but since that time a number of specimens of the same variety have been collected for us from the ponds among the paddy fields there. This same form has also been collected for us from Amoy and this is also the first record of a fresh water sponge from the region around Amoy. The *Spongilla carteri* var. *melli* often forms masses larger than one's fist growing around a twig or some other support in the water. Sometimes it may even form a layer over the surface of a clod in the water. The type of this species is preserved in the University Zoological Museum in Berlin. We have a piece of the original material from Canton in our collection.

Trochospongilla latouchiana, Annandale.—This is really a new addition to the list as Dr. Annandale recorded this as his first impression but later changed his identification to the variety *T. latouchiana* var. *sinensis*. We find these two forms to be distinguishable with ease when the extremes are examined but doubtless there are intermediate forms also as it is at times somewhat confusing to find the two forms in the same slide. This point needs further investigation.

3. *Trochospongilla horrida* var. *ningpoensis* Gee.—This new variety was described and illustrated in the April, 1926, China Journal of Science and Arts. The material from which it was described came from the rocks near the overflow of water from East Lake in Chekiang Province. The specimen was simply a bit of the surface growth on the rock and was so intermingled with algal and other growth that no special skeletal structure was able to be distinguished. The determination was made from the spicules, both skeletal and gemmule, and their close resemblance to those of the *Trochospongilla horrida* left no doubt but that they were from a closely related form so we gave it the varietal name "*ningpoensis*" as this lake is very near Ningpo. There are slight differences between the gemmule spicules of this and *T. horrida* and more marked differences in the skeleton spicules in that those of the variety are thinner and have decidedly smaller spines on them. The type is in our collection.

4. *Trochospongilla tunghuensis*, Gee.—This species was described in the same article in which the above variety was described. It was found in the same type of surrounding as the sponge just described above and we have also found a few spicules of the same sponge scattered through some of the slides of Soochow sponges. It resembles most closely *Trochospongilla phillottiana*, Annandale, but the spicules, both from the skeleton and from the gemmules are of much larger proportions. The skeleton spicules are not so uniformly rounded at their ends as is the case in the *T. phillottiana*, but they may be either rounded or rather bluntly pointed. The gemmule spicules are considerably larger than those of *T. phillottiana*. The type of this new species is in our collection.

5. *Ephydatia fluviatilis*, auct.—This is a very old species and also one of very wide distribution. The earliest description of it is by Lamouroux in 1824, in the Encyclop. Method II, p. 327. Most of the larger specimens of sponges in our collection belong to this species and we have specimens of it from Kiangsu, from Chekiang, from Shantung and from Chihli. It is often as large as a small bath sponge and looks very much like one of them. Its general manner of growth is much influenced by the environment and it is sometimes difficult to detect the species from its general external appearance. Dr. Annandale evidently overlooked this species in the materials which we sent him and thus we record it for the first time from China. This is so far the most common and the most widely distributed of any of the fresh water sponges recorded from China.

6. *Ephydatia fluviatilis* var. *chui*, Gee.—We described this new variety from material collected by Prof. Chu, in Chi Jao, in 1925. The description was published in the China Journal of Science and Arts of April, 1926. The proportions of both the skeletal and the gemmule spicules differ from the type by being smaller, thinner ahd more delicate. The gemmules in this variety are also very abundant and are scattered

throughout ths entire sponge, whereas in the specimens of the usual form of *E. fluviatilis* from Soochow the gemmules are usually very much fewer in number and are more localized, being generally near the center of the sponge. We have the type of this variety in our collection.

We wish to add two new records to the occurrence of sponges in China. This brings the number of fresh water sponges known from China at present up to twenty one (21) forms.

Spongilla lacustris has been sent us from one or two points in Manchuria by Mr. Skvortzow. This species has already been found in other parts as indicated above.

Ephydatia japonica, Hilgendorf.—Mr. Skvortzow has also sent me a small bit of sponge which came from a lake near Harbin. In this I have found the species *E. japonica*. This is a new occurrence for this form in China though it is found in several places in Japan. This sponge was first described by Hilgendorf as a variety of *E. mulleri* in Sitaungel. Ges. Naturf, Facunde, Berlin, 1882. Writers on sponges have thought the variety *japonica* to be sufficiently different from the type to entitle it to specific rank. Our specimen from Harbin was mixed with another sponge of the genus *Spongilla*.

In securing a collection of materials of this nature one has to rely upon the assistance of those in the various places who are willing to cooperate in gathering the specimens for study. We have been very fortunate in having a number of friends who have been most helpful to us in accumulating a collection of Chinese fresh-water sponges from Canton, from Amoy, from several places in both Chekiang and Kiangsu provinces, from Tsinan, from Peking and from two places in Northern Manchuria. We are indebted to Prof. W. E. Hoffmann, Prof. F. A. McClure and Prof. R. B. Falkenstein from Canton; to Mr. Hsien W. Wu and Dr. C. Ping from Amoy; to Prof. Y. T. Chu, Dr. F. C. Crawford and others from Chekiang Province; to Dr. C. F. Wu, Prof. C. K. Wang, Prof. J. T. Illick, Prof. Nelson Chen, Prof. T. P. Sun and others from Kiangsu; to Prof. Chin and Prof. Jacot from Tsinan; to Dr. P. W Claassen, Mr. H. J. Chu, Dr. Kessel and Dr. C. F. Wu from Peking; and to Mr. B. W. Skvortzow of North Manchuria for helping us to secure our collection. We wish here to express our appreciation and our thanks to these friends who have made our studies on this group possible.

We have as yet no adequate collection from any other areas than Soochow and Nanking and are very eager to have more materials from different localities even in the same city. In this way new things are often collected by people who are not famillar with the characteristics of the different kinds of sponges. We are very anxious now to secure specimens from new parts of the country, especially the interior, in order to have some basis for a preliminary study of the distribution of the fresh-water sponges of China.

The fresh-water sponge fauna of China is already quite rich. Only eight species are as yet known from Japan and to date we have already recorded twenty one (21) species from China where collections have been made from very few localities. Doubtless collections from more extended areas will reveal many new forms.

Sponges may be found growing as films or masses of very variable size and thickness on the surfaces of stones along the water's edge in canals, streams or ponds. They may also frequently be found covering portions of wooden piles or wooden structures of any kind which have been in the water for several years. A favorite place for them is on the water covered parts of stone or wooden bridges. Water plants, eel-grass (Vallisneria), Myriophyllum, Elodea, etc. and the leaves and stems of water-reeds, all may frequently provide specimens. The bamboo fish traps nearly always bear sponges if they have been in the water some time and even rice stuble covered with water may have sponges in it.

In collecting one should be careful always to remove the basal layer of the specimen as this often contains the gemmules which are so helpful in making determinations. A thin batter-cake turner often used by the cooks or a spatula will be very helpful in loosening the specimen from its support on a rock. If the sponge is growing on a piece of bark covered wood it is wise to strip the bark from the pole and thus get the basal layer on the bark. Dry the specimens out in the shade, then wrap each of them in a soft piece of paper (do not use cotton as it sticks all over the sponge and is troublesome to remove), put the date, the locality, the type of water in which it is found, etc., with each specimen and mail them in a tin box to our address. We will be glad to look them over and identify them for you. We will also be glad to refund any postage or other expense in packing the specimens to send to us.

The best time of year to collect sponges is in the late fall and during the winter months. The water usually becomes lower in canals and ponds at this season of the year and thus may leave exposed and dry the sponges that grow at high water level during the summer. Then, too, sponges usually form gemmules, the reproductive bodies, at this season so that if they are killed by the drought or the cold weather there will be a new generation of sponges formed from the gemmules.

Much work yet remains to be done on this interesting group of animals and only the smallest beginning has been made as yet. We desire to secure as representative a collection of material as possible in this group and hope in the course of time to be able to make a fairly adequate report upon the fresh water sponges of the whole of China. This is impossible, however without the cooperation of many people in many places and we are anxious to secure this kind cooperation.

LIST OF COLEOPTERA FROM FUKIEN PROVINCE, CHINA

Determined by the British Museum*

By C. R. Kellogg

Professor of Zoology, Fukien Christian University, Foochow, China.

Cicindelidae

Collyris crassicornis Dej.
Cicindela aurulenta F.
Cicindela candei Chevr.

Carabidae

Carabus delavayi Fairm.
Dolichus chinensis Sem.
Anchomenes magnum Bates

Dytiscidae

Sandracottus fasciatus Aubé.
Cybister sugillatus Er.
Cybister 3-punctatus Ol.
Rhantaticus signatipennis Cast.

Gyrinidae

Dineutes marginatus Sharp.
Dineutes mellyi Rég.
Gyrinus orientalis Rég.

Histeridae

Hister schieri Mars.

Languriidae

Anadastus praeusta Crotch.

Coccinellidae

Novius rubra Muls.
Synonycha grandis Thunb.
Halyzia ? cincta F.
Chilomenes 4-plagiata Swartz.
Chilomenes 4-plagiata Swartz, var.
Chilomenes 6-maculata F.
Coelophora biplagiata Swartz.
Coccinella 7-punctata L.
Alesia discolor F.
Epilachna 28-punctata F.

Cleridae

Stigmatium rufiventris White

Elateridae

Melanotus restrictus Cand.

Lampyridae

Luciola ficta Oliv.

Lucanidae

Aegus laevicollis Saund.
Eurytrachelus platymelus Saund.
Lucanus fortunei Saund.
Neolucanus championi Parry.
Odontolabis sinensis Westw.

Aphodiidae

Aphodius marginellus F.
Aphodius sorex F. var. *analis* F.
Aphodius brachysomus Solsky.

Copridae

Onitis falcatus Wulf.
Catharsius javanus Lansb.
Catharsius molossus L.
Copris sinicus Hope
Copris confucius Har.
Copris reflexus F.
Liatongus cinctus F.
Liatongus vertagus F.
Gymnopleurus sinuatus Ol.
Onthophagus sagittarius F.
Onthophagus rectecornutus Lansb.
Onthophagus quadricornis F.
Onthophagus proletarius Har.
Onthophagus orientalis Har.
Onthophagus tragus F.
Onthophagus lenzii Har.
Onthophagus ater Waterh.
Onthophagus lunatus Har.

Melolonthidae

Microtrichia nigra Redt.
Melolontha serrulata Gyll. var.
Apogonia cribicollis Burm.
Apogonia splendida Boh.

Rutelidae

Chaetadoretus hirsutus Oh.
Lepadoretus sinicus Brm.
Popillia crassipes Chaus.
Popillia taiwana Arr.
Popillia histeroidea Gyll.
Popillia pustulata Frm.
Popillia mutans Newm.
Mimela testacceoviridis Blanch.
Anomala corrugata Bates
Anomala nigritarsis Nonfr.

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*From the collection of C. R. Kellogg.

Dynastidae

Trichogomphus mongol Arrow

Cetoniidae

Protaetia intricata Saund.
Oxycetonia jucunda Fald.
Oxycetonia jucunda Fald. var. *kuperi* Schaum.
Clinteria davidis Fairm.
Cosmiomorpha setulosa Westw.
Anthracophora rusticola Burm.

Tenebrionidae

Ceropria induta Wied.
Elixota cuprea Pasc.

Meloidae

Epicauta gorhami Mars.
Epicauta ? tibialis Waterh.
Mylabris phalerata Pall.
Mylabris cichorii Lin.

Curculionidae

Apoderus semiannulatus Jek.
Apoderus latipennis Jek.
Apoderus nigroapicatus Jek. var.
Attelabus ? castaneicolor Jek.
Byctiscus congener Jek.
Hypomeces squamosus F.
Astycus flavovittatus Pasc.
Piazomias velatus Chev.
Episomus turritus Gyl. var. *chinensis* Est.
Eugnathus distinctus Roelofs.
Xiphades tubericollis Frm.
Xanthochelus perlatus F.
Alcides roelofsi Lewis.
Alcides trifidus Pasc.
Alcides erro Pasc.
Colobodes ornatus Reel.
Sipalus gigas F.
Cryptoderma fortunei Waterh.

Brenthidae

Baryrrhynchus speciosissimus [Kleine

Cerambycidae

Spondylis buprestoides L.
Chlorophorus annularis F.
Polyzonus fasciatus F.
Cerambyx cantori Hope
Xylotrechus sp. (*incurvatus ?*) [Chev.
Erythrus championi White

Lamiidae

Paraglenea fortunei Saund.
Apriona rugicollis Chev.
Aristobia vecti Thoms.
Aristobia hispida Saund.
Monohammus tesserula White
Monohammus permutans Pasc.

Sagridae

Sagra purporea Licht.

Crioceridae

Crioceris impressa F.
Crioceris ruficollis Baly.

Clytridae

Clytrasoma palliata F.
Gynandrophthalma nigrifrons [Hope

Cryptocephalidae

Cryptocephalus trifasciatus F.

Eumolpidae

Corynodes parryi Baly.
Cleorina janthina Lef.

Chrysomelidae

Ambrostoma fortunei Baly.
Paropsides hieroglyphica Fischer.
Chrysomela exanthematica Wied.
Chrysomela aurichalcea Mann

Halticidae

Ophrida spectabilis Baly.
Ophrida scaphoides Baly.
Podontia lutea Ol.

Galerucidae

Mimastra soreli Baly.
Aulacophora nigripennis Mots.
Aulacophora similis Ol.
Cneorane delatouchii Fairm.
Oides bowringi Baly.
Oides 19-punctata Bilb.
Paridea perplexa Baly.
Sphenoraia singularis Har.
Galerucella maculicollis Mots.

Cassididae

Laccoptera chinensis F.
Aspidomorpha micans F.
Prioptera chinensis F.
Metriona circumdata Hbst. var.

ORTHOPTERA FROM FUKIEN PROVINCE, CHINA

By C. R. Kellogg*

Professor of Zoology, Fukien Christian University, Foochow, China.

Identified by the British Museum.

Acrididae

1. *Acrida lata* Motsch.
2. *Aiolopus tamulus* F.
3. *Catantops pinguis* St.
4. *Cantantops splendens* Thnbg.
5. *Ceracris sp.* (probably *laeta*) Bol.
6. *Erianthus versicolor* Burm.
7. *Euprepocnemis hokutensis* Shir.
8. *Euprepocnemis shirakii* Bol.
9. *Gastrimargus sundaicus* Sauss.
10. *Gastrimargus transversus* Thnbg.
11. *Heteropternis respondens* Walk.
12. *Hieroglyphus annulicornis* Shir.
13. *Hieroglyphus tonkinensis* Bol.
14. *Oxya velox* F.
15. *Patanga succincta* L.
16. *Trilophidae annulata* Thnbg.

Gryllidae

17. *Liogryllus bimaculatus* Degeer

Identified by Dr. Morgan Hebard.

18. *Acrida turrita* L.
19. *Conocephalus maculatus* LeGiullou
20. *Gampsocleis sinensis* Wlkr.
21. *Heteropternis varia* Wlkr.
22. *Oedaleus marmoratus* Thnbg.

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*Collected by Professor C. R. Kellogg.

Note.—Of the above species Nos. 1, 2, 3, 9, 11, 14, 16, and 18 appear in the "*A Preliminary List of the Acridiidae of China*" by Prof. H. S. Chang (*The China Journal of Science and Arts*, Vol. I. pp. 486-493 and Vol. II. pp. 64-70, 1923 and 1924) but in Prof. Chang's list the localities were given as from "China" and one must have access to the literature references given in order to ascertain the specific localities in case they have been recorded. In the present list all are from Fukien Province and in addition the species numbered 7, 8, 15, 19, and 20 represent genera not included in the list given by Prof. Chang.—Ed.

A LIST OF COCCIDAE (SCALE INSECTS) KNOWN FROM CHINA

By Inokichi Kuwana

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The following list of *Coccidae* has been recorded in the entomological literature of the world, as occurring in China. Those species included in this list designated by an asterisk(*) have been reported from our Quarantine. Many additions would undoubtedly result from special collecting.

The writer would like to receive specimens from China and will be glad to name them insofar as they are known to him.

Subfamily MONOPHLEBINAE

Species	Host plant
Drosicha burmeisteri (Westw.)	Pine
Drosicha contrahens Walk.	
Drosicha maskelli Ckll.	Pine, *Gardenia florida*
Icerya purchasi Mask.	Citrus, acacia, etc.
Icerya seychellarum (Westw.)	Citrus and other plants
Villigera frauengeldi Kaisck.	

Subfamily ORTHEZIINAE

Orthezia insignis Dougl.	Lantana and other plants

Subfamily DACTYLOPIINAE

Antonina graminis (Mask.)	Grass
Eriococcus exiguns Mask.	
Eriococcus graminis Mask.	Bamboo, grass
**Pseudococcus bekeri* Essig	Citrus
**Pseudococcus citri* (Risso.).	Citrus
Pseudococcus cocotis (Mask.).	Coconut, hibiscus
Pseudococcus filamentosus (Ckll.)	Citrus and other plants
Pseudococcus graminis var. *orientalis* (Mask.)	

Subfamily TACHARDIINAE

Tachardia decorella (Mask.)	Tea plant and orther plants

Subfamily COCCINAE

Ceroplastes ceriferus (And.)	Tea plant, citrus, etc.
**Ceroplastes floridensis* Comst	Oleander, mango, fig, tea plant, citrus, *Ilex globra*, etc.
Ceroplastes cajani (Mask.)	*Cajanus indicus* and other plants
Ceroplastes rubens Mask.	Citrus, tea plant, pear, *Mangifera indica*, etc.
Coccus diacopeis And.	Citrus
Coccus ficus (Mask.)	Fig
Coccus hesperidum (Linn.)	Oleander, citrus, Ivy, etc.
Coccus longulus (Dougl.)	Citrus, ficus, papaya, etc.
Coccus melaleucae (Mask.)	Melaleuca, etc.
Coccus sinensis Mask.	Sugar cane
Ericerus pela (Chav.)	*Ligustrum glabrum*, etc.
Lecanium ficus Mask.	Ficus
Lecanium globulosum Mask..	*Stillingia sebifera*
Mallococcus sinensis (Mask.).	*Callicarpa tomentosa*
Paralecanium geometricum (Green)	*Laurus canariensis*
Pulvinaria psidii Mask.	Tea plant, citrus, coffee, etc.
Saissetia hemisphaerica (Targ.)	Camellia, croton, citrus, etc.
**Saissetia oleae* (Bern.)	Citrus, olive and other plants

Subfamily DIASPINAE

Aspidiotus bossicae Mask.	Grass
Aspidiotus camelliae Boi.	*Cercis siliguastrum*
Aspidiotus cydoniae Comst.	Casuarina, hibiscus, etc.
Aspidiotus cymbidii Bouche.	Cymbidium
**Aspidiotus destructor* Sign.	Palms, mango, banana, etc.
Aspidiotus dictyospernei Morg.	*Erythrina indica*
**Aspidiotus duplex* Ckll.	Citrus
Aspidiotus implicatus Mask.	Campanula
**Aspidiotus latanae* Sign.	*Buxus japonica*
Aspidiotus meyeri Marl.	Abies

**Aspidiotus perniciosus* Comst.	Pear, apple, etc.
Aulacaspis crawii (Ckll.)	*Elaeagnus umbellata*
**Aulacaspis rosae* Bouche.	Rose, raspberry, etc.
Chionaspis (Phenacaspis) chinensis Ckll.	*Quercus sp.*
Chionaspis (Phenacaspis) cockerelli Cooley.	Palm
Chionaspis (Phenacaspis) eugeniae Mask.	*Eugeniae elliplica* and other plants
Chionaspis micropori Marl.	Poplar
**Chionaspis n. sp.*	Bamboo
**Chrysomphalus aonidum* (Linn.).	Citrus and other plants
Chrysomphalus aurantii (Mask.)	Citrus, fig, etc.
Chrysomphalus dictyospermi (Morg.)	Citrus, mango, & other plants
Chrysomphalus rossi (Mask.)	Palms, arancaria, etc.
Fiorinia bambusae Mask.	*Bambusa fortunii*
Fiorinia chinensis Fer.	———
Fiorinia fioriniae Forg.	Podocorpus, tea plant, etc.
Fiorinia nephelii Mask.	*Niphelium longana*
**Lepidosaphes beckii* (Newm.)	Citrus
Lepidosaphes flava var. *hawaiiensis* (Mask.)	*Pyrus sinensis*
**Lepidosaphes gloverii* (Pack.)	Citrus and other plants
Lepidosaphes pomorum Bouche.	*Ailanthus glandulosus*, etc.
**Leucaspis japonica* Ckll.	Palatanus
Parlatoria chinensis Marl.	Crab-apple
**Parlatoria pergandii* Comst.	Tea plant, palms, etc.
Parlatoria proteus Curt.	Citrus and other plants
Parlatoria proteus var. *virescens* Mask.	*Pyrus sinensis*, etc.
Parlatoria pyri Marl.	Pear
**Parlatoria sinensis* Mask.	Citrus
**Parlatoria ziziphus* (Lucas)	Citrus
Pinnaspis (Hemichionaspis) aspidestrae (Sign.)	Fern, *Aspidestra lurida*, etc.
Pinnaspis simplex Fer.	———
**Prontaspis citri* Comst.	Citrus and other plants
**Sasakoaspis pentagona* (Targ.)	Peach, plum, cherry, etc.

COCCIDAE FROM CHINA*

With a List of Host Plants

By William E. Hoffmann

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In the preceding pages Dr. Kuwana has given a list of the Coccidae or Scale Insects from China as known to him. In checking over the list in the insect collection of Lingnan University the writer found a number of species, 21 to be exact, that were not included in Dr. Kuwana's list. Those 21 species are listed in Part I of the following notes along with the plants on which they were found. This material was collected by Professor C. W. Howard and identified by Mr. Harold Morrison

In a compiled list of all the Coccids which have been reported from China according to the records of the Bureau of Entomlogy of the United States Department of Agriculture, kindly furnished to the writer some months ago by Mr. Harold Morrison of the Bureau, are to be found 40 species not recorded by Kuwana nor represented in our collections. Part II of the present list contains the names of the 40 additional species. Data relative to the host plants of these species are not at hand and therefore can not be included.

The Coccid fauna of China as recorded is certainly very much less extensive than one would expect. Undoubtedly this is due to the fact that comparatively little collecting has been done in this interesting group. The great economic importance of some of the scale insects as well as the ease with which they are introduced from one place to another makes it highly desirable that we get acquainted with our Coccid fauna as rapidly as possible. It is with the idea of aiding in this undertaking even in a slight measure that the present list has been prepared.

Part I

MONOPHLEBINAE

Genus Icerya Sign.

Icerya aegyptiaca (Dougl.) .... *Litsea glutinosa*
,, *jacobsoni* Green .... *Canarium pimela*

TACHARDIINAE

Genus Tachardia Blanchard.

Tachardia fici Green .... *Ficus benjamina* and *Gironnura nitida*

Tachardia theae (Green & Mann).... Persimmon

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*Contribution from the Biological Laboratory.

PSEUDOCOCCINAE	
Genus PHENACOCCUS Ckll.	
Phenacoccus hirsutus Green	*Ahelemoschus esculentus*
COCCINAE	
Genus PULVINARIA Targ.	
Pulvinaria polygonata Ckll.	Orange
Genus SAISSETIA Desplanches.	
Saissetia nigra (Nietn.)	Guava, *Muchelenfickia platycladoo*, and *Lysimachia decurrens*
DIASPINAE	
Genus ASPIDIOTUS Bouché	
Aspidiotus cocotiphagus Marl.	*Melia azedorack*, Guava, and Willow
Aspidiotus lataniae Sign.	*Acacia sp.*
,, *transparens* Green	*Litsea glutinosa*, *Ficus pumila*, and Guava
Genus MORGANELLA Ckll.	
Morganella longispina (Morg.)	*Pinus messoniana*
OTHER SUBFAMILIES	
Genus AULACASPIS Ckll.	
Aulacaspis pentagona (Targ.)	*Prunus mume*, *Prunus persica*, *Litsea glutinosa*, *Gomprena globosa*, and *Pittsporum panciflorum*
Genus CHIONASPIS Sign.	
Chionaspis acuminatus Green	*Severinia buxifolia*
,, *elongatus* Green	*Bambusa multiplex*
,, *graminis* var. *divergens* Green	*Paspalum scrobiculatum*
,, *subcorticalis* Green	*Rhodomyrtus tomentosa*
Genus FIORINIA Targ.	
Fiorinia theae Green	Gardenia (cultivated)
Genus HEMICHIONASPIS Ckll.	
Hemichionaspis minor (Mask.)	*Pinus messoniana*
Genus LEPIDOSAPHES Shimer	
Lepidosaphes tubulorum Ferris	*Sapium sebiferum*

Genus Parlatoria Targ.

Parlatoria pergandii camelliae Comst. *Jasminium undulatum*, *Photinia pruniflora*, & *Cinnamoneum cassia*

Genus Phenacaspis Cooley & Ckll.

Phenacaspis thoracica Robinson ...... *Litsea glutinosa* and *Uvaria miscrocorpa*

Part II

MONOPHLEBINAE

Genus Drosicha Walker

Drosicha corpulenta (Kuwana)

ASTEROLECANIINAE

Genus Asterolecanium Targ.

Asterolecanium bambusa Bdv.
,, *miliaris* Bdv.
,, *pseudomiliaris* Green

PSEUDOCOCCINAE

Genus *Chaetococcus* Mask.

Chaetococcus bambusae (Mask.)

Genus Pseudococcus Westw.

Pseudococcus comstocki Kuw.

Genus Erioccus Targ.

Erioccus onukii Kuw.

COCCINAE

Genus Ceroplastes Gray

Ceroplastes rubens minor Mask.

Genus Coccus Linn.

Coccus elongatus (Sign.)

Genus Lecanium Burm.

Lecanium corni Bouché
,, *excrescens* Ferris
,, *kunoensis* Kuw.
,, *prunastri* Fonsc.

Genus Pulvinaria Targ.

Pulvinaria aurantii Ckll.

- PROTOPULVINARIA
  - *Protopulvinaria pyriformis* Ckll.
- Genus ASPIDIOTUS Bouché
  - *Aspidiotus bilobis* Mask.
    - ,, *cryptomeriae* Kuw.
    - ,, *cryptoxanthus* Ckll.
    - ,, *excisus* Green
    - ,, *palmae* Morg.
- Genus CHRYSOMPHALUS Ashm.
  - *Chrysomphalus aurantii* var. *citrinus* Coq.
- Genus ODONASPIS Leon.
  - *Odonaspis inusitata* (Green)
    - ,, *pencillata* (Green)
- Genus PSEUDAONIDIA Ckll.
  - *Pseudaonidia duplex* (Ckll.)
    - ,, *paeoniae* (Ckll.)
    - ,, *trilobitiformis* (Green)
- Genus AULACASPIS Ckll.
  - *Aulacaspis major* (Ckll.)
- Genus CHIONASPIS Sign.
  - *Chionaspis citri* Comst.
    - ,, *euonymi* Comst.
    - ,, *micropori* Marl.
    - ,, *salicis* (Linn.)
    - ,, *yanonensis* (Kuw.)
- Genus DIASPIS Costa
  - *Diaspis boisduvalii* Sign.
- Genus FIORINIA Targ.
  - *Fiorinia minor* Mask.
- Genus LEPIDOSAPHES Shimer
  - *Lepidosaphes bambusae* Kuw.
    - ,, *conchiformis* (Gmel.)
    - ,, *ulmi* (Linn.)
- Genus PHENACASPIS Cooley & Ckll.
  - *Phenacaspis latissimus* (Ckll.)
- Genus PINNASPIS Ckll.
  - *Pinnacaspis buxi* (Bouché)
- Genus POLIASPIS Mask.
  - *Poliaspis pini* Mask.

BIOLOGICAL NOTES ON *LACCOTREPHES*
(Hemiptera, Nepidae)*

By William E. Hoffmann

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The aquatic bug discussed in this paper is a water-scorpion belonging to the family Nepidae and the order Hemiptera. It is the species known in literature as *Laccotrephes ruber* Linn. or *L. grossus* F. but according to a recent paper by Dr. Teiso Esaki(1) this species should be called *L. Kohlii* (Ferrari) having been described as new by Ferrari in 1888 under the name "*Nepa Kohlii.*" The genus is characterized by Distant(2) as follows: "Body oblong or elongately subovate; pronotum about as long as broad, sometimes a little shorter than broad, a little sinuately narrowed anteriorly, where it is about twice as broad as head and behind which it is profoundly concavely sinuate, its base in front of scutellum also strongly concavely sinuate, transversely constricted behind middle, between which and anterior margin are two discal longitudinal rugosities; scutellum slightly longer than broad; membrane complete, reticulately veined; legs of moderate length, anterior femora incrassate and beneath longitudinally sulcate, the anterior tibiae a little shorter than the femora," and is found in the Ethiopian, Oriental and Australasian Regions. The species is described as: "A smaller and narrower species than *L. robustus*, in colour generally fuscous, sometimes piceous; abdomen above reddish-ochraceous, usually with a central longitudinal fuliginous fascia, the apex brownish-ochraceous, sometimes, but rarely, with the whole disk suffused with fuliginous; wings vitreous; abdominal appendages a little longer than the body; hemelytra subparallel. Length 30 to 35; breadth between post. pronotal angles 7 to 9 millim." by Distant and has been reported from India, Ceylon, Burma, Formosa, Japan, and China.

The family Nepidae is represented in Kwangtung province, according to our collections, by two species of *Ranatra*, one species of *Cercotmetus*, one species of *Nepa*, and the species of *Laccotrephes* herein discussed. Although common in Kwangtung this bug is not well known to the natives only a few of whom have a name for it. This testifies to the bug's ability to render itself inconspicuous which it does by covering its back with mud. The bug is called *Shui ha maau* (水下猫) in the Cantonese dialect, which translated literally means" under water cat."

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* Contribution from the Biological Laboratory.

(1) Bull. Brooklyn Ent. Soc. Vol. XXI, No. 5.

(2) Faun. Brit. Ind. Rhynchota. Vol. III.

Habitat.—Found commonly in pools, ponds, ditches, and small streams. It it essentially a mud-loving bug and apparently pays little or no attention to vegetation. It is usually found in shallow water near the edge and sometimes out on the bank. In the water they usually have the head pointed in the direction of deeper water to which they hasten when disturbed.

They are not fastidious about their environment for they are found in water varying in temperature from that which obtains in a small unshaded puddle to that found in a mountain stream, and varying in cleanliness from distinctly polluted and filthy to that clean enough for drinking purposes. They seem to prefer, however, bodies of water that are about midway between these extremes, although it is likely that the food is the determining factor rather than temperature or degree of pollution.

Hibernation.—These bugs have been taken at frequent intervals, during the past three winters, by ordinary collecting methods and showed no signs of hibernation. They are more difficult to find during the colder weather and are less active at this time.

During the winter of 1924-25 the writer kept some specimens in a small aquarium. Three specimens, one male and two females, were collected October 3, and about three weeks later they worked themselves into the mud in the shallow water and remained quiet. They took food which was so placed that they could get it without moving from their position but ignored any not so conveniently placed. Food was offered every four or five days but by the last of November the bugs were entirely covered with mud excepting the caudal one third of their respiratory tubes and they could no longer be tempted with food. One of the specimens was then removed from its chosen place and placed on the wet earth at one end of the aquarium. It made its way immediately into the water and by the next morning was again hidden except for the respiratory tube which was in contact with the surface film of the water. A glass lid was then placed on the aquarium to reduce the amount of water lost by evaporation and no more attention paid to the bugs.

During the following spring the writer was very busy owing to a heavy teaching schedule and neglected to observe when the bugs came out of hibernation. The last recorded observation was on the fifth of February at which time the bugs were still hibernating. How much longer they remained in their winter sleep can only be conjectured. Eggs were not deposited, however, until July 12 by one female and a few days later by the other. This is very late and perhaps was due to the fact that the bugs had remained a long time in hibernation.

The aquarium in question had been placed in a cold sub-basement room on the north side of a building. During the winter months the average temperature in the room was lower then the average outside temperature while during the spring the difference in temperature was still greater.

During the winter of 1925-26 some more adults were kept over winter. These did not show any evidence of a desire to hibernate but the conditions were not so favorable for hibernation as in the first experiment and the results cannot, therefore, be compared directly. These bugs were kept in an aquarium made from a Standard Oil tin in one end of which was placed a bank of sandy soil. The rest of the vessel contained shallow water but there was not the layer of mud that the first aquarium contained. The bugs were not fed during the months November to January (inclusive).

The bugs in this aquarium, as said above, did not hibernate but they did become less active during the colder days (of which there were only a few at a time). There are three possible reasons why these bugs did not hibernate: (1) the dirt bank was steep and fairly hard with the result that there was not present a quantity of mud into which the bugs could easily bury themselves; (2) the room although in a sub-basement had both an east and a south exposure and received warmth from the sun; (3) the bugs were ones that had been reared in the laboratory and used to lower temperatures than would be in the case of bugs out in nature.

In both of the above cases the bugs were not kept over the winter for a study of hibernation but for other reasons. These notes on hibernation are, then, simply a result of gleanings make from records kept for another purpose. It was planned to carry out definite hibernationexperiments during the winter of 1926-27 but time did not permit.

Courtship.—Just before mating there are some antics that might well be considered as constituting courtship. Hewitt (Ent. Soc. Lond. Trans. 1906, p. 87) says of *Nepa* "there are no preliminary amorous passages in the courtship of *Nepa*" and goes on to explain that the reason may be that the antennae are too short for any 'caressing of antennae.' He further states that the antennae appear not to be used for discovering the presence of the female.

In the observation under discussion the female *Laccotrephes* was in a horizontal position on a bit of vegetation while the male was above her but not holding to her. He was manipulating his anterior legs in a rapid and excited manner, movements suggestive of a boxer at sparring or shadow boxing, a part of the time just making motions and a part of the time touching the female on the back or legs. During this time the female remained perfectly quiet.

Mating.—After several minutes of courting the male grasped the anterior femora of the female, they being directed at right angles to her body. The female holding on to the vegetation with her intermediate legs attempted to kick the male off using her posterior legs. The intermediate legs of the male were placed against the basal one third of the female's posterior legs, while his hind legs were placed against the middle of her posterior tibiae thus rendering her posterior legs ineffective in the struggle. The vegetation was very unstable and their footing rather insecure. For an instant they were connected but in the next instant the female got the advantage in the struggle and their genitalia were disconnected. The writer then put his hand under them and removed the bugs to a shallow dish, they remaining in embrace while he did so. A moment before the above mentioned connection was effected the male gradually worked backward on the female. To accomplish this he pulled her anterior legs back until the femora and the thorax formed an acute angle, and then suddenly gave up his hold on her anterior legs and grasped her by the thorax.

As the male attempted to effect a connection in the shallow vessel he grasped the anterior portion of the female's thorax. As he did so the female reached back with her anterior legs, grasped the distal portion of his anterior femora, thus attempting to prevent the male from moving backward far enough to connect their genital organs. Nine minutes from the time they were first connected he attempted it again, but the female reached back with her right anterior leg, caught his right anterior leg and pulled him loose. The female then maneuvered backward and sideward to capture a tadpole, the male still upon her back. He then left her of his own accord, frantically described a circle of about three inches in diameter, suddenly returned at right angles to her right side and mounted. He made no attempt however, to connect, left her again, swam nervously about, then awkwardly and half-heartedly chased a tadpole (they had not been fed for several days and no doubt were very hungry). Then he attempted to feed on the same tadpole with the female but was not permitted to and swam away to the left. Soon he turned and swam rapidly toward her left side (at right angles to her middle), mounted wrong end to, quickly turned around and attempted to copulate from the left side. Failing this (through no fault of the female) he shifted and effected an entrance from the right. In this position his thorax was forward and downward. Then they remained :—

connected for 3½ minutes, disconnected for 15 seconds
,, ,, 2½ ,, , ,, ,, ,, ,,
,, ,, 3 ,, , ,, ,, 5½ minutes
,, ,, 5½ ,, , ,, ,, 4½ ,,

The third time they disconnected it was her wish as she scrambled until the separation was accomplished.

During copulation the female continued feeding on the tadpole. Just prior to connecting, the male rhythmically shifted the posterior legs. After the fourth rest, of four and one half minutes duration, the male half-heartedly attempted another connection.

This pair of bugs was taken from a common container of six specimens which had been collected in May. Whether they had mated before cannot be said. This observation was made on July 26 a little after ten o'clock in the morning. The next day at noon the bugs were in copulation and the male was again mounted to the right.

On the 23rd of July another mating pair was observed. The female was reared in the laboratory becoming an adult on the first day of July. A male was placed with her on the twenty-second of July. When observed at noon the next day they were in copula, the male mounted to the left. His right anterior leg was over the right front angle of her thorax, the right intermediate leg grasping her right side just back of her intermediate leg. The left legs were holding to vegetation, a tangled mat of which the bugs were on, touching the female lightly and not really grasping. The right posterior leg was not used at all. The right wing of the male overlapped the left of the female, but the tip of his abdomen was bent downward and to the right so as to come underneath the tip of the abdomen of the female. The respiratory tubes of the male were slightly parted at their base, allowing the genital organs to extend upward and connect with the female genital organs immediately above. The respiratory tubes of the male, then, were directly under those of the female at their base and then directed to the left, thus forming an obtuse angle. This was at ten o'clock in the morning. When an attempt was made to observe them with a hand-lens they discontinued mating. The next morning at nine they were mating again. At noon they were placed in an oil-tin squarium which was provided with a dirt bank and on the following day a big batch of eggs was laid.

In some mating pairs the male is mounted more to the side, the venter being almost at right angles to the lateral edge of the female. There is also some variation in the position of the respiratory tubes during mating. In some cases those of the male are pushed under and beyond those of the female at the base, and then instead of pointing back toward the male they remain on the side of, and parallel to those of the female. The respiratory tubes of the two bugs are parallel then but crossed at their proximal ends.

In a given pair the male is usually consistent in effecting a connection always from the same side, but exceptions have been noted in one or two cases.

Preoviposition.—A female which became an adult on July 1 in the laboratory appeared gravid by July 22 and a male was introduced into the aquarium on this date at noon. They were mating the next day at noon and probably had also mated the day they were placed together. July 24 dirt was provided for egg-laying and the next day eggs were laid, thus laying eggs on the 25th day. Undoubtedly the preoviposition period would have been shorter had this bug been kept in a place where the average temperature was equal to that of the outside temperature, instead, the temperature of the room was considerably lower. Perhaps the presence of a male earlier might have shortened the preoviposition period. The one record, of course, only gives an idea as to the duration of the preoviposition period; more observations will need to be made to determine the normal or average.

Oviposition and Fecundity—Oviposition in the laboratory was observed with a reading glass. In the oil-tin aquaria slanting mud banks had been prepared. Sometimes the eggs were laid on a flat area on the uppermost part of the artificial bank but more often where the bank was steep. In the latter case the female takes a position of head downward. The ovipositor is bent far forward so its juncture with the body forms an acute angle. The eggs are placed on end and are smeared over with mud leaving only the filaments protruding. A place where the eggs have been laid is plainly visible as a smooth, more or less spherical area. A closer inspection reveals the distal ends of the egg filaments which instead of being in a regular circle as is the case with the eggs of *Nepa* usually are in no regular order (fig. 9). Only occasionally does a single egg at the edge of the mass have its filaments placed in a regular manner. One cannot tell the exact location of eggs within the mass by the appearance of the filaments. The egg mass of *Ranatra chinensis* when in place is similar to that of *Laccotrephes,* but in the case of *Nepa* the exact location as well as the number of eggs can be determined simply by counting the crowns of filaments. *Nepa* eggs are usually more or less scattered and further the fact that the filaments are quite short accounts for their regular arrangement.

One female was timed while depositing eggs and found to require $2\frac{1}{2}$ hours to deposit twelve eggs. This particular individual commenced egg-laying at 8.15 p.m. During the afternoon she had escaped but was recaptured. Apparently she wanted to return to nature to lay her eggs.

She was collected May 7 and appeared gravid at the time. Three days later she dropped three eggs to the bottom of the aquarium. Mud was purposely not provided in order to ascertain if she could be induced to deposit in either green or dead plant stems. During the night of May 15 she dropped eight more eggs although she had been removed during the day to an aquarium containing dirt. On May 22 she laid 12 eggs. Later her aquarium was needed and she was transferred to a battery jar containing water only. On June 11 she appeared gravid and was returned to her original home where she laid 25 eggs during the night. On June 19 she laid 23 eggs, later four more eggs were laid (exact date not known), and on July 9 she laid 24, making a total of 99 eggs during an interval of 61 days.

One female collected July 19 laid a batch of eggs late in August, another September 5, another on the 10th of September and still another on September 19. The first batch contained 25 and the last one 19 eggs. Those in the second and third batches were not counted. As many as 35 eggs have been deposited at one time by one female but about 2 dozen seems to be the average number.

The female referred to under *Preoviposition* molted to an adult July 1 and laid eggs on July 25 and again July 31. She died September 1.

Egg-laying always took place at night. The eggs are deposited in mud as they are in the case of *Ranatra chinensis, Curicta drakei* and at least two species of *Nepa*. Occasionally the eggs are pushed into the mud until the upper ends are just flush with the dirt, leaving the filaments exposed for thir full length, but more often the eggs are covered with about a millimeter of dirt. (fig. 9).

Incubation—Eggs laid in the laboratory May 22 required 13 days for hatching; eggs laid during July and August required 12 days. Out in nature where the temperature would be higher the incubation period would no doubt be shorter.

Hatching.—One morning about nine o'clock the writer had the good fortune to observe eight eggs hatch. He had patiently watched one small area of earth on a slanting bank for three hours when suddenly he noticed it move. A hand-lens was quickly brought in focus and every detail carefully noted. The little roundish area of soil, conspicuous with the whitish egg filaments, was pushed straight up until it fell forward and revealed the head the anterior margin of the thorax of eight little nymphs, whose ventral sides were facing down the slope. Some remained accurately upright until they were entirely out of the egg capsule, others leaned forward before they were entirely hatched. Some were free from the egg and had fallen over on their ventral sides before the legs (which were directed downward and closely appressed to the body) moved out and away from the body, while in others the legs were being vigorously kicked in freeing the nymphs from the eggs. In one or two cases the nymphs were standing exactly vertical and nothing but the respiratory tubes remained within the egg capsule. When these were out the nymphs fell forward and crawled away. Hatching from the time the earth cap was moved upward required about five minutes.

Behavior of the Newly Hatched.—The little nymphs are quite active immediately upon hatching and move down the sloping earth to the water which they enter without much loss of time. Upon hatching the nymphs are bright red with jet black eyes. During the first hour no perceptible color change takes place but within the next hour and a half they become wine-colored. The change takes place so gradually that one looking at them continuously can hardly detect it. Upon entering the water the nymphs find a suitable depth and bring the respiratory tubes in contact with the surface film. They are fully colored within four or five hours and are ready for mosquito larvae within 10 or 12 hours.

Number of Instars.—There are five nymphal stages. The duration of the several stadia is indicated in the table of rearings.

Molting.—Nymphs lose interest in food for a period varying from a few hours to a day before molting. Experiments seem to point to the fact that hunger is the deciding factor, for those which had less food than they desired fed up to within a few hours of molting time. The fifth stage nymphs usually refuse food for a longer period before molting than do the other stages. The period of rest before molting is probably long in some cases because molting in delayed. Nymphs are usually ready for food as soon after molting as they are fully colored, which requires from four to five hours. This period is also subject to variation and apparently depends upon the vitality, those individuals in which molting seems to be easily and quickly accomplished seem to be stronger and take food earlier. The actual molting time, which requires only a few minutes, also varies with different specimens. Some are out of the skin except for a leg or two and then give up the struggle. If they receive help at this time they often live but if the aid is not given at just the right time the leg will be deformed. If the deformity is slight it will disappear with the next molt. Occasionally a nymph will molt unaided but will die immediately upon completion of the task, probably of exhaustion. If death occurs at molting time it is usually before the skin has split. In this respect *Laccotrephes* differs widely from *Lethocerus* for in the latter many nymphs die after the skin has split preparatory to molting.

Previous to molting the nymphs become less active and somewhat bloated in appearance. The skin is tightly stretched and the bug becomes unshapely. The thorax especially looks elongated and unnatural and as if the three regions were going to separate. In the fifth stage the wing pads become dark one day before molting. Mortality at molting time, at least under laboratory conditions, is not high.

Sexual Maturity.—Very little data are at hand regarding this point. Female No. 5-215 was not given a male until the 22nd day after she became an adult. They probably mated the same day but it was not convenient to observe them on this occasion. The next day, however, they were seen mating. How much earlier the female would have mated cannot be said. She was gravid at that time, however, showing that she was sexually mature some days earlier. She deposited eggs on the 25th day of adult life. This was during July and the female was one that had been reared from the egg.

Fertility.—But few data were obtained relative to fertility. In the above case the female laid fertile eggs the third day after mating for the the first time. A few data were secured on the duration of time a female remained fertile after mating. A gravid female was collected May 7. She was never given an opportunity to mate, but the eggs she laid during the rest of the month, and up to and including June 19 hatched. Eggs laid July 9, however, did not hatch.

Longevity.—Two specimens collected October 3, 1924 lived over until the following fall, one dying September 3, the other October 11, making a total of one year and eight days for the latter. The bugs laid eggs in July and August. They were probably of the late summer brood of 1924. Some specimens reared September 1925 lived over until late August 1926 when the work was discontinued. In spite of the fact that they were not fed sometimes for days at a time, even during the summer, and their water allowed to get extremely foul, several were still alive, and as late as the middle of August one pair was observed mating. There is no doubt but that these insects would have gone well over the year mark if properly cared for.

The longevity of water bugs is a subject of much interest to the writer and one on which we have comparatively little data. The writer has not had time to keep Chinese aquatics for longevity records, but a few years ago was able to secure some data on the longevity of American water–bugs. One of the most interesting records was that of *Velia watsoni* Drake observed in Minnesota from specimens collected in Kansas. These lived for eighteen months and reproduced during two different seasons (Canadian Entomologist, May, 1925. p. 109).

Number of Generations.—Adults that live over the winter deposit eggs the following spring and summer over a considerable period. Some commence egg–laying rather early, others much later. Because of this it is impossible to check up on the number of generations from field observations alone. Field and laboratory observations thus far seem to indicate one generation and a partial second. In other words the adults maturing from the eggs laid early in May themselves lay eggs during the summer and the bugs hatching from these reach maturity in the fall and live over the winter as adults. Bugs becoming adults in July and August do not lay eggs until the following spring.

Food Habits.—*Laccotrephes* is carnivorous, feeding upon terrestrial and aquatic insects, tadpoles, and small frogs. They undoubtedly would feed upon small fish if they had an opportunity. In the laboratory they fed upon a great variety of land and water insects. The earlier instars apparently preferred mosquito larvae and pupae while the later instars showed a preference for tadpoles. The adults seemed not to show any particular food preference. Field and laboratory observations indicated that both nymphs and adults were very fond of mosquitoes. It is surprising to note what large tadpoles a very small nymph will attack and manage, and equally surprising to observe an adult capture and eat insects as small as *Drosophila*, a leaf hopper, or an adult mosquito. An adult *Laccotrephes* was once observed to capture an agile *Rhagadotarsus* but it apparently did not like it and soon released it.

While this water-scorpion consumes great quantities of food, the adults at least, can survive with a surprisingly small amount of food. In the laboratory the 4th and 5th instar nymphs would manage a large tadpole every day. When very hungry both nymphs and adults pursue their victims, but at other times they lie in wait, partially buried in the mud, with the strong anterior legs spread out in readiness. When an unwary insect or tadpole happens to pass over or near these sharp grapple hooks, there is a swift simultaneous closing in of the front legs, and the unsuspecting victim is doomed. The prey is held tightly between the fore legs while its juices are sucked.

Behavior.—Adults spend some of the time out of the water but nymphs have never been found on the bank. Adults found on land were always near the water's edge and facing toward the water. The few specimens found out of the water have always been found in the late afternoon.

Enemies.—Hydracnid mites are parasitic on the nymphs and adults of *Laccotrephes* and as many as a dozen or more are sometimes found on one bug. They are found on almost any part of the body and sometimes are so numerous and so placed as to hinder locomotion and other functions. The remains of *Laccotrephes* have been found in the stomachs of toads and fish. In the laboratory water snakes and turtles have fed upon them. Frogs probably eat them when they can catch them. The adults, when on the bank, might possibly fall prey to lizards of the genus *Eumences*, although such has not been observed. The lizards are often found at the water's edge of pools frequented by *Laccotrephes*; they of ten catch very large specimens of praying mantis and grasshoppers, and in the laboratory will feed on any insect offered. Ducks undoubtedly eat them for pools frequented by ducks are often absolutely devoid of insect life. The writer is of the opinion that *Laccotrephes* does not have serious inroads made upon it by predacious enemies.

Use in Mosquito Control.—As mentioned under *Food Habits* the nymphs and adults are very fond of mosquito larvae and pupae. Individual specimens of *Laccotrephes* have been observed to consume tremendous numbers of immature mosquitoes in a day. The writer used this species along with a number of other aquatic Hemiptera in mosquito-eradication work on the campus of Lingnan University with very gratifying results. With the coming of the spring rains innumerable temporary aquatic environments are formed, and while these are eventually populated with mosquito-destroying insects, often it is not until after a generation or so of mosquitoes have been bred. The method of utilizing these bugs in control work consisted of collecting them from the permanent ponds and streams and causing them to be more evenly and rapidly distributed. This was largely a matter of speeding up a natural course of events but not entirely so inasmuch as bugs were introduced into places where they would not go of their own accord.

A number of different insects were successfully used in this way, but *Laccotrephes* and *Sphaerodema* proved the most successful. There are several reasons why this method of combatting mosquitoes, in this locality at least, is practical. They are: (1) the use of fish, oil, or poison as methods of control is impractical; (2) the bugs are abundant and easily secured; (3) no particular skill is required (the children of a community may be engaged to do it as a part of their recreation); and, (4) it is an effective, yet inexpensive method.

Economic Status.—This species is decidedly a beneficial insect in this region. It not only normally destroys many mosquitoes but can be used successfully in anti-mosquito work. In some of the smaller fish ponds it of course eats insects that would serve as fish food, but the greater number of *Laccotrephes* are found in bodies of water where there are no fish. Our observations indicate that the good this species does overbalances by far the harm, and it should therefore be considered a beneficial insect of considerable importance.

Description of Stages

Egg.—The whitish eggs (fig.7) are 3.53 to 3.72 mm. in length and 1.35 to 1.39 mm. in width (in greatest diameter). The filaments, 5 to 9 in number, are 2.55 to 2.79 mm. in length and usually curved. If the long axis of the egg be viewed in one plane the sides are more or less parallel, if in another plane it becomes evident that the egg is quite rounded on one side and more or less straight on the other. The lower end tapers considerably, the upper or micropylar end somewhat. The filaments are arranged in a circle .4 to .6 mm. in diameter and nearer the straight side of the egg. In hatching the upper ends of the eggs, with the filaments, come off. Figure 10 shows the inside appearance of the egg-caps in place in the crust of earth. By the asterisk-like design one can determine the number of filaments by looking at the inside of the cap. Figure 11 shows the appearance of the egg mass after hatching, the black spots being the empty eggs which appear to be only holes in the earth until one looks more closely and sees the empty egg capsules lining the holes.

The variation in the number of egg filaments in certain water-scorpions is very interesting. The eggs of *Curicta drakei* have from 12 to 17 filaments, the eggs of *Nepa cinerea* are said to have 6 and 7 filaments, *Nepa chinesis* has 10-14, and *Nepa apiculata* has 9 to 13. Hungerford (Kansas University Science Bulletin, Vol. XI, p. 157) saya *N. apiculata* lays eggs bearing 11 filaments, but the writer found the number to vary from 9 to 13.

In *Laccotrephes* the number varies from 5 to 9, the average for 203 eggs being 6.47. Table I shows the variation in detail. It is interesting to note that the number never varies more than 2 in a given batch of eggs as for example 5 to 7 in No. 1, or 7 to 9 in No. 6.

TABLE I.

Variation in the Number of Filaments of Laccotrephes Eggs

Egg Batch	No. of Eggs	No. of Filaments	Total No. of Eggs	Av. No. of Filaments Per Egg
No. 1	2	5	25	6.28
	14	6		
	9	7		
No. 2	1	5	23	6.21
	16	6		
	6	7		
No. 3	19	6	24	6.20
	5	7		
Nos. 4 & 5*	30	7	42	6.73
	11	6		
	1	8		
No. 6	9	7	16	7.62
	4	8		
	3	9		
No. 7	1	5	16	6.06
	13	6		
	2	7		
Nos. 8 & 9*	14	6	22	6.36
	8	7		
No. 10	1	5	35	6.31
	22	6		
	12	7		

*2 batches of eggs by same ♀.

First Instar.—Nymphs measured dorsally (longitudinal measurements made along median line, beak is not included). Length including respiratory tubes 7.90 to 8.97 mm.; length of head, .97 to 1.06 mm.; length of pronotum .60 to .69 mm.; length of mesonotum .37 to .46 mm.; length of metanotum .23 mm.; length of posterior tibia 2.46 to 2.55 mm.; width of head across eyes 1.20 to 1.25 mm.; width of head between eyes .51 mm.; width posterior margin of pronotum 1.53 to 1.81 mm.; width posterior margin of mesonotum 1.86 to 2.27 mm.; width of posterior margin of metanotum 1.95 to 2.37 mm.; greatest width of abdomen 2.32 to 2.51 mm.

Newly hatched nymphs are reddish with black eyes. Faint, paler areas near center of anterior and intermediate femora; pale median line on thorax. Beneath brighter red.

Older nymphs brownish gray, faintly dappled. Whitish specks near base of anterior tibiae, irregular whitish or pale area near middle of anterior femora. The same markings, but less distinct, on intermediate and posterior legs, the femora of the latter seem to have two such spots. Pale median dorsal line through thorax and half of first abodminal segment, extending to base of head where it forks into a broad U and changes from pale to dark after it reaches anterior margin of eyes (skin separates along this pale line in molting). Middle and hind tarsi each have two long claws. From below abdominal spiracles can be seen, also a wide fringe on the abdomen.

Second Instar.—Very young nymph measured as for first instar. Length of body and respiratory tubes 12.27 mm.: length of head 2.18 mm.; length of pronotum .97 mm.; length of mesonotum .88 mm.; length of metanotum .23 mm.; length of posterior tibiae 3.44 mm.; width across eyes 1.53 mm.; width between eyes .65 mm.; width posterior margin of pronotum 2.51 mm.; width posterior margin of mesonotum 3.11 mm.; width posterior margin of metanotum 3.25 mm.; greatest width of abdomen 3.39 mm.

Legs more dappled than in first instar, anterior ones darker. Abdominal spiracles can be seen from above as well as from below. The tips of the hind angles of the meso and metanotal angles are .69 mm. apart.

Third Instar—Length including respiratory tubes 20.40 mm.; length of head 1.53 mm.; length of pronotum 1.72 mm.; length of mesonotum 2.27 mm.; length of metanotum .37 mm.; length of posterior tibia 4.88 mm; width head across eyes 1.99 mm.; width between eyes .74 mm.; width posterior margin of pronotum 3.62 mm.; width posterior margin of mesonotum 4.83 mm.: width posterior margin of metanotum 4.92 mm.; greatest abdominal width 5.20 mm.

Similar to preceding instar. Hind angles of mesonotum prolonged and suggestive of wing pads. Tips of mesonotal and metanotal angles .79 mm. apart.

Fourth Instar.—Length of body including respiratory tubes 29.06 mm.; length of head, 1.86 mm.; length of pronotum 2.51 mm.; length of mesonotum 2.32 mm.; length of metanotum .18 mm.; length of posterior tibiae 6.64 mm.; width head across eyes 2.51 mm.; width between eyes .97 mm.; width posterior margin of pronotum 4.74 mm.; width across tips of mesonotal wing pads 6.32 mm.; greatest width of mesonotum 6.69 mm.; width across tips of wing pads of metanotum 6.78 mm.; greatest abdominal width 6.88 mm.

Hind angles of metanotum look quite a little like wing pads and those of the mesonotum decidedly so. The mesonotum now covers up more of the metanotum. The tips of the wing pads of the mesonotum are only .65 mm. from the tips of the hind angles of the metanotum.

Fifth Instar.—Length 42.22 mm.: length of head 2.79 mm.; length or pronotum 3.48 mm.; length of mesonotum 3.62 mm; length of posterior tibia 9.43 mm.; width head across eyes 3.16 mm.; width between eyes 1.30 mm.; width posterior margin of pronotum 7.53 mm.; width across tips of mesonotal wing pads 8.64 mm.; greatest width of mesonotum 10.69 mm.; greatest abdominal width 9.48 mm.

The tips of the mesonotal wing pads now cover those of the metanotum, in fact all of the metanotum is now covered by the mesonotum excepting a small triangular area on either side. In this instar the posterior margin of the metanotum and none of the first abdominal segment split in molting. Wing pads turn dark one day before molting to adult.

Method of Rearing

Adults were collected and placed in battery jars, aquarium jars, oil tins, and other available containers, the number of bugs in each vessel depending upon its size. When mating pairs or gravid females were found they were isolated in containers suitable for egg-laying. These latter containers were prepared by cutting out one side of a Standard oil tin, thus making aquaria 14 inches long, 9 inches wide and 9 inches deep. These were given two coats of white paint, inside and out, which not only prevented rusting but provided a place to write the life history number and other data. Permanent data were, of course, placed on cards but this enabled one to make temporary notes which facilitated observation. Such notes as "expected to hatch Fri. p.m.," "record first observed mating" and "observe and time entire molting process" facilitate the work when one in caring for 150 or 200 containers and must make frequent observations in order so get exact detailed data on particular happenings. In each container an artificial bank was constructed in one end by placing first a layer of sand and then dirt. In the rest of the container the water was about 2 inches deep. The sand being higher than the water level kept the water from becoming muddy.

Nymphs, as they hatched frem eggs in these containers, or were collected from pools and ditches, were isolated. The vessels used varied in size from smaller than a petri dish to dishes eight inches in diameter. One specimen was reared to maturity in a dish ¾ inch deep and 2¾ inches in diameter. Most of them were kept in petri dishes until they reached the 4th instar and then were transferred to larger dishes. The petri dishes were covered with the regular lids, the larger containers covered with wire screen. The size of the container seemed not to alter the size or well being of the individual, the amount of food, however, did.

Food was given once each day and each day the remains of the previous day's feeding were removed. They were given all the food they cared for; water was changed frequently enough to prevent it from getting foul. In the larger containers where the water was deeper some vegetation was introduced for support. Each container was given a number and on 4×6 cards bearing the same number, important data were recorded. One or two nymphs were reared on much less food than the rest with the result that they were much smaller in size. The nymphs can be reared collectively but the mortality rate is then slightly higher.

Summary of Life History Studies

The accompanying table shows the data obtained in the rearing experiments. By reference to the table we see that nine specimens were reared from the moment of hatching to maturity. The sex was determined for six of the nine specimens showing 2 males and 4 females. Of the 38 life histories attempted, 9 died, five were killed for specimens, 1 escaped, while the records for three were lost. Many of the nymphs were not isolated at hatching time but just after molting. In the cases where nymphs of unknown ages were isolated an asterisk appears after the number of days indicating incomplete record. The sex was recorded in the case of fifteen specimens of which 7 were males and 8 females. In computing the average, minimum, and maximum duration of a given stage of development, or of total nymphal development, only complete figures were used, for instance, if a nymph died in the fifth stage only the duration of the first four stages was taken into consideration. Averages were not secured by considering always the same number of individuals. It thus happens that we determine the time required for development of the first stage by taking the average time required for 20 individuals, for the second stage by 27 and so on, the number of individuals being shown by the number in parentheses.

Data are shown for partial rearings as well as for complete ones in order to show the mortality rate, the relation of death to molting time, etc. The dates on which the specimens reached the adult state are given in order that one may know the rate of development for a given time of the year*.

The average duration of the first stadium for twenty specimens was 4.5 days (minimum 4, maximum 7 days); the average duration of the second stadium for twenty-seven specimens was 4.9 days (minimum 4, maximum 6 days); the average duration of the third stadium for twenty-four specimens was 6.4 days (minimum 5, maximum 9 days); the average duration of twenty-three fourth stage nymphs was 13.9 days (minimum 11, maximum 15 days). The time required for development increases with the later instars until in the last instar it is more than three times as great as that for the first instar.

The nine specimens carried through from hatching to maturity required an average of 39.4 days (minimum 36, maximum 41 days) for nymphal development. Adding 12 days for incubation we have a total of 48 days from egg to adult. There appears to be no difference between the sexes in the length of time required for development. The amount of food seemed not to alter the length of time required for maturity but did cause a marked decrease in size. Temperature is an important factor and no doubt these bugs in nature, owing to an average temperature higher than that of the laboratory where these rearings were conducted, would have a shorter development period.

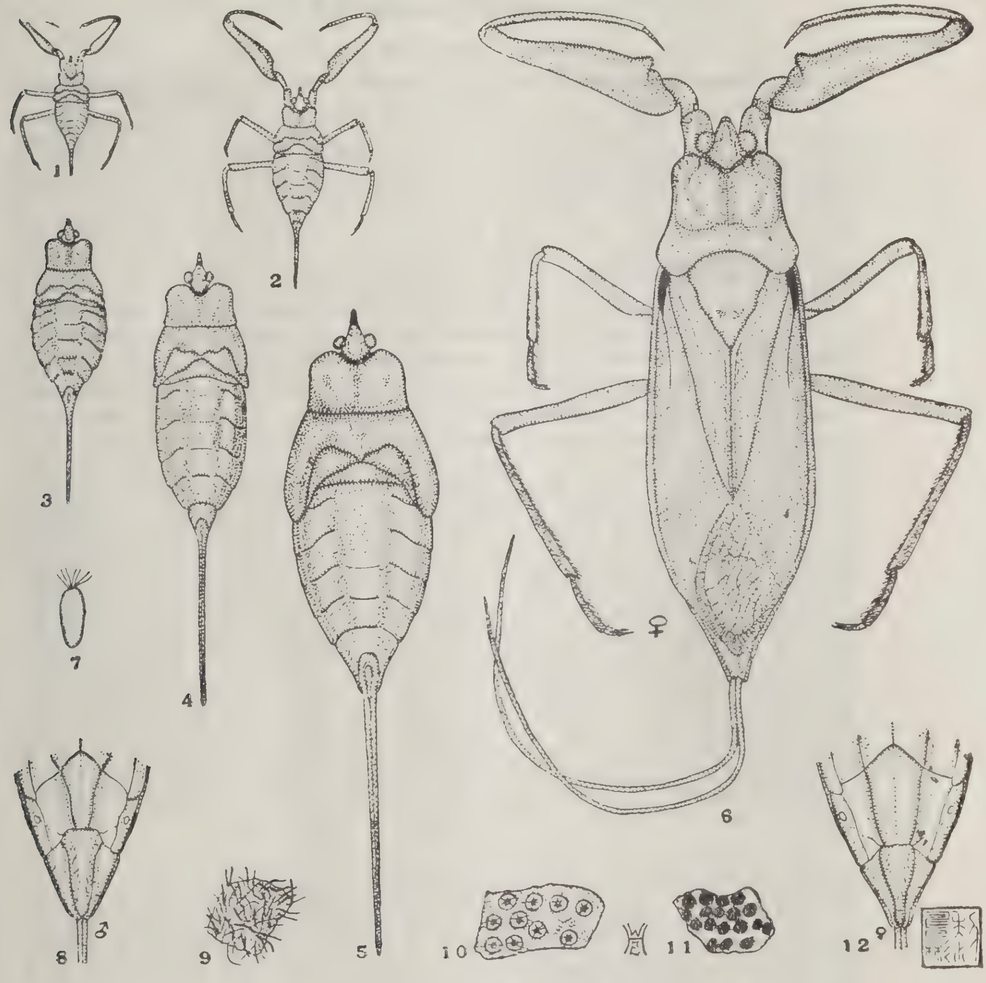
By reference to "Daily Meterological Record, Freeman Meterological Observatory" issued quarterly by Lingnan University, one can get some data on the temperature for any given period of the year. Thermograph records were kept while the rearings on *Laccotrephes* were in progress but these are not available now.

TABLE II.

Table of Rearings of Laccotrephes

REARING NUMBER	FIRST INSTAR	SECOND INSTAR	THIRD INSTAR	FOURTH INSTAR	FIFTH INSTAR	TOTAL DAYS	SEX	DATE OF MATURITY
								1925
5-213	5*	5	rl	—	—	—	—	—
5-214	—	—	—	9*	1d	—	—	May 27
5-215	4*	6	7	7	15	—	♀	July 1
5-218	—	—	7*	10	3k	—	—	June 2
5-251	7	6	2d	—	—	—	—	May 31
5-294	4	5	7	10	15	41	—	July 5
5-295	5d	—	—	—	—	—	—	June 9
5-296	5	5	7	rl	—	—	—	—
5-297	5	5	8	10	15	43	—	July 17
5-298	rl	—	—	—	—	—	—	—
5-299	1e	—	—	—	—	—	—	—
5-300	4	5	6	10	15	40	—	July 17
5-301	4	5	7	10	16d	—	—	July 16
5-302	4	rl	—	—	—	—	—	—
5-309	5	k	—	—	—	—	—	June 20
5-496	—	6*	5	3k	—	—	—	Aug. 26
5-497	—	6*	5	7	14	—	♀	Sept. 13
5-499	—	6	8	8	1d	—	—	Sept. 5
5-500	—	6	6	8	15	—	♂	Sept. 17
5-501	—	4	7	8	11d	—	—	Sept. 13
5-502	—	5	8	9	15	—	♀	Sept. 20
5-503	—	4	5	7	14	—	♂	Aug. 30
5-504	—	4	5	8	11	—	♀	Sept. 11
5-505	—	6	5	8	12	—	♂	Sept. 16
5-506	—	5	5	7	14	—	♂	Sept. 16
5-507	4	6	8dm	—	—	—	—	—
5-508	4	6	9	9	13	41	♂	Sept. 24
5-509	5	6	8	8	14	41	♀	Sept. 24
5-510	6	3k	—	—	—	—	—	Aug. 23
5-511	6	4	3k	—	—	—	—	—
5-512	4	4	6	8	15	37	♀	Sept. 18
5-513	4	4	5	7dm	—	—	—	Sept. 1
5-514	4	4	5	9	1d	—	—	Sept. 4
5-515	4	4	5	8	15	36	♀	Sept. 17
5-516	4	4	5dm	—	—	—	—	Aug. 25
5-517	4	4	7	10	15	40	♀	Sept. 21
5-696	—	—	—	11	12	—	♂	Sept. 2
5-918	4	6	8	6	12	36	♂	Oct. 4
AVERAGE	4.55 (20)	4.92 (27)	6.41 (24)	8.52 (23)	13.94 (18)	39.44 (9)	—	—
MINIMUM	4	4	5	6	11	36	—	—
MAXIMUM	7	6	9	11	15	41	—	—

*—incomplete. rl—record lost. d—died. k—killed for specimen.
♂—male. ♀—female. dm—died molting.
Proportion of sexes : Males 7, Females 8.



LACCOTREPHES KOHLII (Ferrari)

(Magnification 2 ×)

Figs. 1-5—Instars one to five, respectively.
Fig. 6—Adult female.
Fig. 7—Egg.
Fig. 8—Ventral aspect, tip of abdomen, male.
Fig. 9—Eggs *in situ*, filaments only visible.
Fig. 10—Ventral aspect of Fig. 9, showing inside view of egg-caps.
Fig. 11—Empty egg-capsules after crust of earth with egg-caps has been removed.
Fig. 12—Ventral aspect, tip of abdomen, female.

GENERAL NOTES *

China Branch, American Society of Parasitologists

The American Society of Parasitologists is an organization of students of parasitology and closely related subjects which had its inception at Johns Hopkins University, when Professor R. W. Hegner and Dr. E. C. Faust conceived the idea of such an organization. A preliminary inquiry as to the need for the organization was sent out through the secretary of the Helminthological Society of Washington during the spring of 1924. The organization of the society was effected at the Washington meeting of the American Association for the Advancement of Science (Christmas 1924). All persons doing clinical or research work in the subject are eligible. The administration of the society rests in the officers, consisting of president, vice-president, and secretary-treasurer, in addition to the Council. At present there are nearly five hundred members, mostly resident in the United States.

The China Branch of the Society was organized by Dr. E. C. Faust of Peking Union Medical College during the spring of 1926. Thus far about fifty members have been elected from China, consisting of about equal numbers of Chinese and Americans. This branch of the parent society has a Chairman and a Secretary-treasurer, the former being a member of the Council of the parent society. The present officers for this branch are: Chairman, Dr. E. C. Faust, Peking Union Medical College, and Secretary-treasurer, Professor Chenfu F. Wu, Yenching University. The function of the China Branch of the Society is to stimulate the interest in parasitology among workers in the Orient. The dues are One Dollar (U. S. currency) per year or the equivalent in Peking dollars. Applicants for membership should write the Secretary-treasurer of the China Branch, Peking, giving degrees, position held, address, and enclosing membership fee for the first year.

An organization meeting of the China Branch was held in Peking during the meeting of the China Medical Association, September 6, 1926. At this meeting, aside from the business transacted, there was an address given by Professor Georgina Sweet of Melbourne University, Australia, on the relative importance of parasitology in China and Australia. It is proposed that there will be a professional meeting of the Society in Peking at the next China New Year.

During January of the present year the first issue of the *Quarterly Bulletin of the China Branch of the American Society of Parasitologists* appeared. This bulletin of fourteen pages contains notes on the organization of the branch society, a list of members, news items, and a paper entitled "Working Check List of the Trematodes Recorded from Man and Mammals in the Sino-Japanese areas" by Professor Ernest Carroll Faust, Ph. D. Abstracts of papers read at the society's meetings will appear in later issues of the quarterly bulletin.

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* By William E. Hoffmann,

The Peking Laboratory of Natural History

Biologists in China, especially in North China, are showing considerable interest in a young and growing scientific association which is the outgrowth of the Marine Biological Laboratory opened during the summer of 1925 at Peitaiho. This laboratory, now known as the Peking Laboratory of Natural History, is a voluntary association of specialists in the various branches of Natural History, working in close co-operation with the Peking Society of Natural History which was founded September 21, 1925.

The work of the Peking Laboratory of Natural History is the systematic description and illustration of the plants and animals of China and their publication in a uniform series of monographs, according to a broad general plan. At present partial lists of species, and descriptions of some of the Chinese animals and plants are found scattered in scientific periodicals all over the world. They are for the most part unavailable to the average student in China, not only because they are so widely scattered, but also because they are in a multitude of foreign tongues. English is the language to be employed in the monographs of the laboratory and with it for each volume, as comprehensive a summary in Chinese as appears desirable. The aim is to present in series of uniform character the complete fauna and flora of China. This is of course an undertaking of many years, even decades, and the plan of publication has sufficient elasticity to enable the publication of any complete unit whenever it is available. Though each field is under the direction of a specialist connected with the laboratory staff, who at the same time is the editor of the particular series of monographs pertinent to his field. contributions from others are acepted provided they are complete systematic descriptions of a unit group, whether that unit represents a genus, a family, an order or some other unit, biologic, geographic, etc.

The publications of the Laboratory will be confined to monographs on the fauna and flora of China. All smaller papers, such as lists of species, preliminary descriptions of new forms, natural history notes on Chinese animals and plants; etc., will be referred to the Bulletin of the Peking Society of Natural History. The monographs to be issued by the Laboratory will be of quarto form, identical in size and general character of text and plates with the volumes of the Palaeontologia Sinica, issued by the Parent Institution, the Geological Survey of China. Whenever possible. however, the plates will be colored. The monographs will be in two groups: I. Fauna Sinensis, and II Flora Sinensis. Under each group there will be a number of series, each of which is devoted to a special field, this division being in some cases biologic, in others geographic and in still others determined by other reasons. Each series will be in charge of the Curator of the respective department, who is at the same time the Editor of the series.

Under each series there will be a greater or lesser number of volumes. Each volume will comprise from 300 to 400 pages of text and about 30 plates. The volumes will be issed in fascicles, each fascicle a complete treatise on a related group (genus, family, etc), but the larger fascicles may be issued in parts. As each fascicle is paged separately (as in the Palaeontologia Sinica) there need be no rigid sequence in the issuance of the fascicles, any fascicle of any volume appearing whenever that text and plates have been completed.

The treatment is to be systematic, in the first place there being a complete description of the species, according to modern systematic methods, with the aid of full illustrations. A complete synonymy and bibliographic reference will be given whenever it seems desirable The description is to be complete-whether the species has been described before or not, though part of the description may be a quotation of the original description, the object being the presentation of a complete monograph without requiring the student to refer to the original scattered literature, except for purposes of more extended research. The description and illustration shall be so complete that any one using them can readily identify his material.

Following the systematic description there will be an account of the habitat, conditions, and all other purposes, and all other natural history notes of interest, together with reference to Chinese folk-lore and literature and such other facts as will be of interest to the general reader desirous of acquiring knowledge of Chinese animals and plants.

The Laboratory stands ready to act in the capacity of a clearing house of natural history information. It would be glad to receive information or reports from laboratories, institutions, and individual workers concerning their special lines of investigation. In would also be glad to put local workers along similar lines into communication with each other.

The Laboratory will endeavor to serve as a medium of exchange of information between individual workers or institutions concerning special literature, availability of specialists in certain lines of work for the determination af animal or plant forms, of the availability of suitable materials for individual research or for class use in the schools.

Specialists in all parts of China are invited to write to the Laboratory stating their special fields of research and whether or not they would be prepared and willing to identify materials in their special lines if sent to them, and whether or not they would be willing to furnish identified materials from their localities.

Second Session,- Summer Institute for Science Teachers

The Summer Institute for Science Teachers is a recent innovation in China for the purpose of improving the efficiency of science teaching in secondary schools and colleges. It owes its origin to three educational institutions, namely, the Chinese Association for the Advancement of Education, the China Medical Board in Peking, and Tsing Hua College. These institutions, convinced of the need of improving science teaching in our schools, inaugurated this organization to provide science teachers opportunity to further their studies and to improve their methods of teaching by actually learning and experimenting during the summer vacation. The courses of instruction in the Institute, which were only 4 weeks in length, consisted exclusively of fundamental sciences, i. e., physics, chemistry and biology, and to each of these courses was assigned a teacher, or a "leader" as he was called, for conducting the experiments and discussions. The "leaders" were selected from the professors of leading universities in China, chiefly workers of recognized authority in their respective lines. The first session of the Institute was held at Tsing Hua College in the summer of 1924, with an attendance of over 130 students, who, after the close of the session, went back with a great deal of satisfaction.

The success of the first session of the Institute merited a repetition. But owing to the disturbances in China, the second session of the Institute did not become a fact until the summer of 1926 when the Science Society of China also joined the organization. The China Foundation for the Promotion of Education and Culture, in accordance with its plan to improve science teaching, also cooperated with the Institute in providing a large part of the funds for inviting prominent scientists to the Institute to give lectures and for other expenses which were necessary for the success of the Institute. The scope of the work of the Institute for 1926 was therefore enlarged to include a college teachers conference which was attended by delegtes from different universities and the teachers of the Institute as well. It lasted ten days. The problems which were brought up for discussion in the conference were roughly as following: how to improve science teaching, how to improve scientific textbooks in middle schools, the standard for college matriculation and for advanced degree, the possibilities of cooperation between scientific departments of different universities, and finally, the organization and promotion of research work which some of the universities proposed to take up in the near future.

The second session of the Institute (which was to have been held in Nanking during the summer of 1925) was again held at Tsing Hua College, with a still larger atttendance of both teachers and students. They worked together with great enthusiasm amidst the incessant sounding of great cannons, and at the end of 4 weeks, about 98 percent of the students satisfactorily completed their requirements.

In view of the fact that this Institute has rendered good service in promoting scientific studies and in preparing science teachers to give better instruction, and seeing that the requirement on the part of science teachers for an opportunity to improve their knowledge will continue to grow, it has been decided by the organizations which were responsible for the formation of this Institute, to put it on a permanent basis. This will enable the Institute to continue its service to the educational world for many years to come, and to increase the number of the Institutes, thus extending its advantages to a greater number of science teachers.

On October 18, 1926 a meeting of the Board of Directors of the Summer Institute for Science Teachers was held. At that meeting the following recommendations were passed:

1. That in the future one institute should be held in the north and one in the south.

2. That the curriculum of the institute should be broadened to include a course of "General Science."

3. That the Conference of Professors should be a separate feature from the institute.

4. That the China Foundation should ask for the cooperation of the Science Society and the National Association for the Advancement of Education so as to insure the continuity of the Summer Institute.

Another Pan-Pacific Research Institute

Shortly after the close of the Third Pan-Pacific Science Congress, at a dinner given at the Masujima Estate, Higakubo Park, Azabu, the actual plodding research workers among the scientists in Tokyo were offered a social home of their own where they may meet and dine weekly to compare notes and discuss about the dinner table the important food and race problems of the peoples of the Pacific area, who now number more than half the population of the world, and are expected to produce sufficient food for themselves beside supplying a surplus for others, if world peace is to be maintained. This is the culminating problem of the ages.

For the solving of this great problem of the races, and for social entertainments connected with the Pan-Pacific Association of Japan, of which Prince Tokugawa is president, Dr. K. Masujima, founder of the International Bar Association, and a leading Tokyo lawyer, placed the use of his beautiful estate at Higakubo Park, Azabu, with the newly constructed library building and its audience halls, at the service of a committee of the Pan-Pacific Union.

The visiting director of the Pan-Pacific Union, Mr. A. H. Ford, was asked to invite the first group of scientists, and to outline to them the plan of coming together in friendly intercourse and discussion. Colored lantern slides were shown of the work of the Pan-Pacific Research Institute in Hawaii and its wonderful Honolulu grounds and guest houses that are always at the service of visiting scientists who wish to remain in Honolulu for research work.

Those who were invited were primarily the scientists who are interested in the study of food production, protection, and conservation, —the biologists, botanists and entomologists, as well as agriculturists and climatologists. The first program was similar to the regular weekly dinners in Honolulu of the hundred and forty scientists there who compose the Hawaiian branch of the Pan-Pacific Research Institute.

This organization in Hawaii is composed entirely of research workers other than executives and was organized over a year ago by Dr. David Starr Jordan and a number of distinguished research workers from Japan, America, Australia and other Pacific lands, who were guests at the Institute buildings for some months. The chief purpose of the Pan-Pacific Research Institute is to inspire the ordinary research worker and to train him in team work for scientific effort beneficial to mankind, and particularly in that research which may result in the increase of natural food resources and a study of the food desires and consumption of the several races ot the Pacific.

In Hawaii there are councils at the Pan-Pacific Research Institute of entomologists, plant pathologists, plant constituent workers on crop produce and improvement, race and population study, health and sanitation, Pan-Pacific botanical garden, animal husbandry, meteorology and topography. These councils desire similar organizations established in the various Pacific countries with which they may correspond and exchange work. The Pan-Pacific Research Institute publishes its own science journal and maintains a building housing twelve university students, of several nationalities whom it supports and provides with full university scholarships in exchange for service to the scientists. It hopes through some of the advanced foreign students to arrange for the translation and preservation in English of important papers prepared by research workers in the several Pacific Countries.

For nearly two years the members of the Pan-Pacific Research Institute have dined and planned together weekly, the dinner discussion being followed by an illustrated lecture, open to the public.

During the Pan-Pacific Food Conservation Conference in Honolulu, at which practically every country of the Pacific was represented, a magnificent estate in Honolulu of some seven acres was placed at the disposal of the Pan-Pacific Union, the main buildings being used as guest houses for scientists whenever they can find time to visit Honolulu. The Institute does not maintain working laboratories, the scientists having the use of such laboratories in other scientific institutions in Honolulu.

It is hoped that the food research workers of Tokyo and Japan will take advantage of the use of Dr. Masujima's estate to meet together for better acquaintance among themselves and friendly cooperation and correspondence with similar gatherings in other Pacific countries. Any scientist interested in the Race and Food problems of the Pacific is invited to attend the meetings of this group.

List of Chinese Fishes

Biological workers in China will be glad to know that a check-list of the fishes of China is to be published soon by the Pan-Pacific Research Institution in their official publication, the *Journal of the Pan-Pacific Research Institution.* The list has been prepared by Professor Cora D. Reeves, Ph.D , Head of the department of Biology of Ginling College, Nanking.

The title of the list will be "List of Fishes Recorded from Central and North-Eastern China and along the Coast.' We understand that the list will contain more than a thousand species. "List of Fish, Extra Limital" is to be the title of a supplement to the paper and will contain about 200 species. We cannot help but wish that this paper might be more than a list but a start must be made and this is a beginning of no small magnitude. The literature dealing with the fishes found in Chinese waters is widely scattered and extremely difficult to assemble. Perhaps this beginning will serve in some measure as a stimulis for further work and no doubt Dr. Reeves already has other important papers in preparation. References to the literature and such facts as are known about the life histories, habits, and commercial importance of Chinese fishes would be of interest and value. A paper on the fresh-water fish culture of China would be welcomed by workers in China and abroad as well. Such a paper would stimulate interest and bring about further investigation and probably also some experimental work. It is a well known fact that although China is the place of origin of pond fish-culture that the methods in use at present are unscientific and in many respects very primitive. This is more surprising when we realize that the fish industry is the second greatest industry in certain parts of China.

The list of fishes of China is a part of an ambitious program on the part of the Pan-Pacific Research Institution which intends to publish check-lists of the fishes of all the Pacific countries, country by country, as the manuscript comes in. This institution will publish not only lists but other papers giving the results of important research in the various branches of biology. The opportunity to publish in the Journal of the Pan-Pacific Research Institution will not be overlooked by those who have work in progress for in spite of the existence of 25,000 scientific publications a great deal of manuscript still awaits the compositor. The Journal has published three check-lists of fishes as follows: "A Check-list of the Fishes of Hawaii' by Dr. David Starr Jordan and Dr. Barton Warren Evermann," "Check-list of the Fish of Fiji" by Gilbert P. Whitley and "Check-list of the Fish of New Zealand" by W. J. Phillipps.

Tenth International Congress of Zoology

The first circular of information concerning the Tenth International Congress of Zoology, to be held in Budapest, September 1927, has been sent out by Dr. G. Horvath, President of the Congress. At the Ninth Congress, which met at Monaco in 1913, it was resolved to hold the

Tenth Congress at Budapest in 1916, but owing to the war it was postponed. The Tenth Congress will now meet at Budapest, September 4-9 inclusive. It will meet under the patronage of the International Union of Biological Societies, and all zoologists are cordially invited.

Delegates to the Congress will be divided into two groups, *Members* and *Associates*. Members are qualified to vote at all meetings of the Congress, to deliver one or more lectures, to bring proposals before the meetings, and to take part in the discussions, receptions, excursions etc.; they will also receive one copy of the Transactions of the Congress, Associates are entitled to be present at all functions of the Congress, but have no right to vote at the meetings, or to lecture, or to take part in the discussions, nor will they receive the Transactions.

The Offices of the Congress will be in the Hungarian National Museum. There will be four general meetings and a number of sectional meetings, the latter being provisionally arranged as follows: General Zoology, Experimental Cytology, Vertebrata, Invertebrata (excl. of Arthropoda), Arthropoda, Applied Zoology, Palaeozoology, Zoogeography, and Nomenclature.

Excursions during the Congress will include a steamer-excursion on the Danube, visits to the Royal Hungarian Institute of Geology, to the Royal Hungarian Museum of Agriculture, and to the Zoological Gardens. Excursions after the Congress include an excursion to Lake Balaton and official inaugeration of the new building of the Hydrobiological Station of Tihany and a visit to the Puszta Hortobagy with its herds of cattle, horses and sheep, and inspection of the installation of Pisiculture.

China and the Third Pan-Pacific Science Congress

China was well represented at the Third Pan-Pacific Science Congress held in Tokyo in the fall of 1926. Of the 19 countries represented China sent the second largest group of "overseas" delegates. Scientists in China, whether native or foreign, may well be proud of the fact that China was represented by such a large delegation especially at a time when the country was torn with strife and civil war. They may be even more proud that China is a charter member of the "Pacific Science Association," the organization of which is an outstanding feature of cooperation among the scientists of the Pacific in recent years.

Steps toward the formation of this association were taken at the Second Pan-Pacific Science Congress, held in Sydney and Melbourne in 1923, when the following resolutions were adopted :

(1) That this congress recommends the establishment of a permanent organization of the scientific institutions and individuals engaged in research on the scientific problems of the Pacific region;

(2) That the president of the Third Pan-Pacific Science Congress request the National Research Council or similar institution or agency of each of the following countries, *viz.*, Australia, Canada, Chili, France, Great Britain, Japan, Netherlands, New Zealand, the Philippine Islands and the United States of America, to appoint

a member of an organization committee, the chairman of the committee to be a resident of the country in which the congress will be held, and that the committee be empowered to add to its membership representatives from other Pacific countries;

(3) That the organization committee be requested to prepare a preliminary draft of the constitution and methods of procedure of the organization and to report its recommendations to the next congress.

At the final general meeting of the Third Congress the Committee on Permanent Organization presented the draft Constitution and By-Laws of the "Pacific Science Association" and moved their adoption. At this time the president of the Congress read a letter presented by Professor Fen Ch'in of Peking, stating the claims of the Science Society of China for inclusion in the list of representative institutions constituting the Council of the Pacific Science Association. Mr. N. Gist Gee then moved the addition of the Science Society of China to the list, and the motion was seconded by Mr. C. C. Chu, secretary of the Society. After the passage of this and several other amendments the draft constitution was adopted, and thus in the last few minutes of the final gathering of the Congress, China, along with U. S. S. R. (Russia), was admitted as a charter member of this new and important association of Pacific scientists.

The Main objects of the Association are:

(*a*) To initiate and promote co-operation in the study of scientific problems relating to the Pacific region, more particularly those affecting the prosperity and well-being of Pacific Peoples.

(*b*) To strengthen the bonds of peace among Pacific peoples by promoting a feeling of brotherhood among the scientists of all the Pacific countries.

As a means of attaining these objects the Association shall organize Pacific Science Congresses. Those countries, dominions, colonies, territories or dependencies lying within or bordering the Pacific ocean, and those countries having dominions, colonies, territories or dependencies in the Pacific region and interested in the above objects, shall be eligible for admission to the Association, each country being represented either through its National Research Council or some other scientific organization of recognized standing.

It was the Science Society of China, then, internationally known among scientific organizations, that made possible for China membership in the Pacific Science Association.

The list of delegates to the Congress from China was as follows:

Barbour, Professor George B., M. A., Yenching University, Peking, China; representing Yenching University.—*Geology.*

Chen, Professor Huan-Yung (陳煥鏞), D., Sc. South-Eastern University, Nanking; representing the Science Society of China.—*Botany.*

Ch'in, Professor Fen (秦汾) Peking National University, Councillor, Ministry of Education, Peking; representing the Government of China.—*Mathematics, Astronomy.*

Chu, Mr. Coching C. (竺可楨), Secretary, Science Society of China; representing the Science Society of China; Chief Editor of Geography and History Division, Commercial Press, Shanghai.—*Geodesy.*

Dunlap Dr. A. M., Ph. D., Dean, Peking Union Medical College, Peking, China; representing the Peking Union Medical College.—*Medical Science.*

Grant, Professor John B., Ph. D., Peking Union Medical College, Peking, China; representing the Peking Union Medical College.—*Hygiene*

Hoffmann, Professor William Edwin, M. A., Lingnan University, Canton, China; representing Lingnan University.—*Biology*

Hsueh, Professor Te-yu (德), National Wuchang University; representing Chinese Society of Science and Arts.—*Zoology.*

Hu, Mr. Tun-fu (胡敦福), Principal, National Women's College.—

Hu, Professor Pu-tseng (胡步曾), South-Eastern University.

Li, Mr. Chia-fu (厲家), Principal School of Military Surgeon, Chekiang; representing the State Government of Chekiang.—*Medical Science.*

Li, Professor Hsi-mou (李熙謀), Southern University.—*Physics.*

Lee, Professor J. S. (李四光), National Peking University, Peking; Vice Director Peking Metropolitan Library.—*Geology.*

Shen, Professor Tsung Hunt (沈宗翰), Nanking University; Nanking; representing Chinese Agricultural Society and Science Society of China.—*Agriculture.*

Tan, Professor Hsi Hung (譚熙鴻), Peking University, Peking; representing the Chinese Society of Science and Arts.—*Botany.*

Wai Professor Nganshou (魏 壽), Kwang Hua University, Daishi Road, Shanghai; Director, Nganhai Chemical Laborotory; representing the Chinese Society of Science and Arts.—*Agriculture.*

Wang Mr. I-rin (王 林), D. M., Tsing Tau Hospital.—*Medical Science.*

Wong, Mr. Wenhao (翁文灝), Director, Geological Survey of China, Peking; representing the Geological Survey of China.—*Geology.*

Zen, Mr. H. C. (任鴻復), Excutive Sceretary, China, Foundation for the Promotion of Education and Culture; representing the Science Society of China.

Members representing Institutions in China but sent as delegates from the U. S. A.:

Cressey, Professor George B., M. A., Ph. D., Shanghai College, Shanghai, China; representing Shanghai College.—*Geology.*

Gee, Mr. N. Gist, Assistant Resident Director, China Medical Board of Rockefeller Foundations, Peking, China; representing the Peking Society of Natural History and China Medical Board of Rockefellor Foundations.—*Biology.*

Members of Institutions in China but representing American Scientific Societies, and who were members of the U. S. delegation:

Lowdermilk, Professor W. C., University of Nanking, China; representing Society of American Forestry.—*Forestry*

Porter, Professor R. Howard, B. S., University of Nanking, China; representing American Phytopathological Society.—*Plant Pathology.*

LITERATURE*

PERIODICALS

The Quarterly Review of Biology

Of much interest and value to students and teachers of biology in China is a new biological periodical, *The Quarterly Review of Biology*. This journal as the name indicates is a quarterly and is published by the Williams & Wilkins Co., Baltimore. Dr. Raymond Pearl is editor and Professor R. W. Hegner is associate editor. The editors are assisted by an advisory board of fifteen members, each a specialist in some phase of biology.

In an interesting foreword in Volume I, No. 1, Dr. Pearl justifies the origination of still another scientific journal. He points out that the biologist who expects to deal with his problems in any degree of penetration, has got to know a good deal of other subjects, and that this knowledge in the long run has got to be something more than the elementary text book sort, that not even the narrowest specialist believes any science to be sufficient to itself. He says that nature is itself a highly integrated piece of business, of almost infinite complexity, and therefore our intellectual "tool kit" must be well equipped. It is pointed out that the tremendous output of technical information makes it increasingly difficult for the research worker to know a good deal about other fields of science than his own, and at the same time increases the necessity for his so doing. *Biological Abstracts*, it is shown, will be a very great help in this big task, but that abstract journals do not entirely solve the problem, since of necessity they lack coordination.

The Quarterly Review of Biology attempts to give to the reader comprehensive and authentic accounts of the general progress in the several fields of general biology. The articles are written by specialists but technical language is avoided insofar as possible.

It is the editor's hope that the journal will have among its readers many intelligent people who are not professionally scientific workers, and that by spreading coordinated scientific knowledge in this manner, the journal will help in a very real way to combat the menace of Fundamentalism.

The literature review section of the journal is divided into two parts. In the first part there appears a lengthy critical review of one new biological book of outstanding significance. In the second part brief but sententious book notices appear. The books are grouped under several headings such as Evolution, Genetics, General Biology, Human Biology, Zoology, Botany, Morphology, Physiology, Biochemistry, Biometry, Sex, and Psychology and Behavior. About 25 pages of each issue are devoted to the book reviews. In the first four numbers of the *Review* about 300 books, written in several languages, were noticed.

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*The literature notes in this section of the REVIEW were prepared by William E. Hoffmann unless otherwise indicated.

A very interesting and unique feature is the *Fundamentalists Portrait Gallery* in which is published the portraits of the more distinguished Fundamentalists.

Volume I, for the year 1926, contained 26 articles requiring 615 pages.

Biological Abstracts

A very important event in biological progress during the past year was the inaugeration of *Biological Abstracts*, "A Comprehensive Abstracting and indexing Journal of the World's Literature in Theoretical and Applied Biology, Exclusive of Clinical Medicine." The Journal is published under the auspices of the Union of American Biological Societies and in the fields of Bacteriology and Botany it is a continuation of *Abstracts of Bateriology* and *Botanical Abstracts* respectively. The first number, containing 1,878 entries and requiring 202 pages of two columns each, appeared December 1926. The editorial and executive office is maintained at the University of Pennsylvania and the publication office at Menasha, Wisconsin.

The justification for the establishment of this abstracting journal is well put forth in the preface to the first issue which is herewith quoted:

> The increasing interdependence of the various fields of biological science, coupled with the constantly growing volume and complexity of the literature, have in large part furnished the stimulus for the effort, herewith inaugurated, to provide a comprehensive abstracting and indexing organ for the world's literature in theoretical and applied biology.
>
> The necessity of specialization, probably to an increasing degree, is recognized; on the other hand, it is becoming more and more apparent that highly specialized work is more likely to result in sound progress if undertaken with at least reasonable familiarity with contributory fields. Biological Abstracts will therefore endeavor to provide through its current abstract numbers and annual alphabetic and systematic indexes a guide to the literature conveniently arranged by specialties; at the same time through its comprehensiveness it is hoped it may enable specialists to maintain intelligent contacts with related or contributory phases of biology—contacts which in general can be maintained only under some form of abridged reading.
>
> The development of biological science, in common with other broad intellectual fields, is fundamentally non-nationalistic. The same non-provinciality is vital in its literature guides; therefore, Biological Abstracts will strive to give adequate representation within its field to the literature from all lands. In this effort the

widest participation is invited, and is already generously forthcoming, to the end that Biological Abstracts may be the product of a genuine cooperation among biologists throughout the world.

Regarding the purpose of *Biological Abstracts*, we learn from the prospectus as follows:

Purpose. As the name indicates, *Biological Abstracts* is not a reviewing journal, and it does not propose to evaluate contributions critically. It will attempt to furnish impersonal, objective abstracts which shall:

1. Acquaint the reader with the subjects treated and summarize the new contributions authors believe they have made.

2. Make possible the preparation of adequate and accurate annual Subject and Systematic indexes of the original papers.

In brief, Biological Abstracts, through its current abstract issues, will seek to keep readers informed of progress: and, through its abstract and index issues, to provide a comprehensive reference tool.

LANGUAGE.—All citations (titles, authors' names, and sources) will be printed in the original in so far as these are in Latin, Slavic, or Greek-letter languages. All other citations, because of printing difficulties, will be rendered only in English, with proper explanatory statement. The abstracts and indexes will be printed in English.

PREPARATION.—It is hoped that the abstracts may be secured as far as possible from Collaborators resident in the countries in which the various publications, especially serials, are issued. Each collaborator, however, will be invited to assume only a very moderate and non-burdensome responsibility, It is therefore planned to produce the journal through cooperation coextensive with productive activity in biological science.

More specifically, abstracts will be secured mainly in the following three ways;
1. Through authors, who will be invited by the central editorial staff to submit abstracts of specifically designated articles of their own authorship.

2. Through Collaborators responsible for furnishing all necessary abstracts and titles from one or a limited number of specifically designated serial publications assigned by the central editorial staff. This procedure will be followed only in those serials which confine themselves to a limited special field and the contents of which therefore readily fall within the competence of a single specialist.

3. Through Collaborators who will be invited to abstract papers (individually designed by the central editorial staff) which fall within the Collaborators' special fields of interest and linguistic equipment. This procedure will be followed in cases in which it is not practicable or possible to secure the abstracts by one of the first two methods.

Collaborators will be free to prepare abstracts in Italian, French, Spanish, Portuguese, German, or English, as may best suit their convenience. Any necessary translation will be provided by the central editorial office.

The publication of this abstracting service is a cooperative undertaking in which biologists throughout the world are invited and expected to take part. Normally the journal will be issued once each month plus an extra issue containing the index. The thirteen numbers will constitute a volume coinciding with the calender year. Volume I, however, will contain the initial number in 1926 and also all issues appearing in 1927.

The field covered by *Biological Abstracts* is divided into a large number of subject-matter sections, each under the supervision of an editor who may choose associate and assistant editors to aid him. There is also a central editorial staff, consisting of J. R. Schramm as editor-in-chief, and J. A. Detlefsen and V. Rand as associate editors, charged with the general editorial conduct of the Journal.

Regarding the indexes the Journal says the following:

> The permanent reference value of an abstracting journal is conditioned very largely by its indexes, to which especial attention has been directed in planning Biological Abstracts.
>
> The concluding number of each annual volume will be devoted to the three major indexes:
>
> (1) A single Authors' Index for the volume;
>
> (2) A single Alphabetic, Analytic Subject Index for the volume;
>
> (3) A Systematic Index for the volume.
>
> AUTHOR'S INDEX.—Each abstract issue will contain an index of authors represented in that issue. Finally, the single index to all authors whose contributions have been cited in the corresponding volume will be printed in the annual index issue.
>
> ALPHABETIC, ANALYTIC SUBJECT INDEX.—The general character and aims of alphabetic indexes are so well known and their exceptional serviceableness so thoroughly appreciated that no detailed comment seems necessary. In brief, the purpose will be to index information analytically in detail and to arrange the index entries in dictionary fashion in a single alphabet for the entire volume, as is being done so successfully in numerous abstracting services.

The size of the page is 8×10½, the type a large 8-point, set in two columns, each 3×8⅝ inches. The paper is thin but of good quality and quite opaque. A considerable study was made before this particular combination of format, typography, and paper was selected and it is believed that the annual volumes will require not more than three or four inches of linear shelf space.

While *Biological Abstracts* will prove very helpful to biologists the world over it will be especially helpful to biologists in China where there is such a dearth of biological literature. Educational institutions should subcribe for this journal at once in order that they may have complete files.

Journal of the Pan-Pacific Research Institution

During the Pan-Pacific Food Conservation Conference held in Honolulu during the summer of 1924 under the auspices of the Pan-Pacific Union, the Pan-Pacific Research Institution came into being. Sixteen months later (January, 1926) there appeared the first number of a new periodical, the *Journal of the Pan-Pacific Research Institution*, "A periodical Record of Investigations Bearing on Problems of Food Production, Distribution, Conservation and Consumption, as well as Public Health, and Race and Population Problems as Related to the Countries Bordering on the Pacific."

Concerning the Journal its editors say the following: "The Journal of the Research Institution will be open to all research workers who have contributions to the advancement of knowledge of the Pan-Pacific area. It is the feeling, however, that at first the problems of taxonomy in the biological sciences will take precedence, since such records are fundamental to the development of further research. This does not mean, however, that other meritorious research cannot be included from time to time. It is intended that the Journal will publish papers reporting only research of the highest standard."

The contents of the four numbers published during the past year appear below.

No. 1. January, 1926

Objects of the Pan-Pacific Research Institution.

A Check-list of the Fishes of Hawaii

By David Starr Jordan and Barton Warren Evermann.

List of Officers of the Pan-Pacific Research Institution, Editorial Staff, and Information for Contributors.

No. 2. April-July, 1926

Institutes for Research in the Interest of Agriculture in the Netherlands Indies. By P. J. S. Cramer.

No. 3. July-September, 1926

Institutions for Research Work in the Territory of Hawaii.

No. 4. October to December, 1926

Digest of Resolutions of Scientific Interest Passed and Recommendations Made at Conferences Called by the Pan-Pacific Union.

REVIEWS

Aldrich, J. M. Descriptions of New and Little Known Diptera or Two-Winged Flies. *Proceedings of the U.S. National Museum*, Vol. 69, Art. 22, pp. 1-26, 1926.

This paper discusses 22 species (21 of them new) representing 19 genera (8 of them new) in the Dipterous families Cyritidae, Milichiidae, Trypetidae, Anthomyiidae, Calliphoridae, Sarcophagidae, and Tachinidae. Five species are recorded from China; they are *Pelmatops ichneumonea* Westwood in the family Trypetidae, *Mesembrina tristis* new species in the family Anthomyiidae, *Wohlfahrtia atra* new species in the family Sarcophagidae, *Simoma grahami* new species and *Eucomus strictus* new species in the family Tachinidae. *Eucomus* is also a new genus. All of these flies were taken in Szechuen Province.

Chun, Woon Young. Two New Trees from Chekiang. *Journal of Arnold Arboretum.* Vol. 6, No. 3, pp. 144 & 145, 1925.

Torreya Jackii and *Halesia Macgregorei* are described, the former being named in honor of Professor John G. Jack of the Arnold Arboretum, the later in compliment to Mr. Donald MacGregor, Superintendent of Parks, Shanghai. The author points out that the discovery of *Halesia* in China makes another addition to the list of genera once thought to be endemic in America, but subsequently found to be indigenous in China. Some of the genera of woody plants formerly considered purely North American now known to be common to the two countries are: *Hicoria, Liriodendron, Sassafras, Nyssa, Symphoricarpos* and *Halesia.*

Chun, Woon Young. New Species and New Combinations of Chinese Plants. *Journal of Arnold Arboretum*, Vol. 8, No. 1, pp. 19-22, 1927.

Two new species, *Ostrya Rehderiana* and *Cercis Chingii*, are described as new. The first named was collected in Western Chekiang, the latter in Southern Anhwei. The disposition of the types is not stated. A number of new combinations are suggested.

Drake, Carl J. Tingitidae from the Far East (Hemiptera). *Philippine Journal of Science*, Vol. 32, No. 1, pp. 53-59, 1927.

This paper discusses 9 species representing 6 genera, 8 of the species and 2 of the genera being new. The new species are *Monanthia evidens, Oncophysa constantis, Diplocysta nimia, D. nubila, Uhlerites vicarius, Xenotingis bakeria, Alloiothucha philippinensis,* and *A. necopinata. Uhlerites* and *Alloiothucha* are the new genera. *Oncophysa constantis* was described from a specimen taken in Hongkong.

Faust, Ernest Carroll. Bibliography of the Publications from the Laboratories and Clinics of the Peking Union Medical College and Hospital. *P.U.M.C. Press*, Peking China, 1926.

Dr. Faust as chairman of the committee on Publications of the Peking Union Medical College has compiled a list of the papers published by members of the staff of the Peking Union Medical College and Hospital for the period from July 1, 1915 to June 30, 1925. Pages 1 to 58 of the

Bibliography are devoted to the *Author Index*, pages 59 to 149 are devoted to the *Subject Index*. The subject index is divided into various sections such as Anatomy, Biochemistry, Physiology, Pharmacology, Parasitology, Public Health, etc. The references given under each section are arranged alphabetically. In the author index names are arranged alphabetically and the papers by a given author are arranged in chronological order. 656 titles, representing the work of 124 investigators, are listed in this section. Papers that are to be found in the *Contributions From The Peking Union Medical College* are marked with an asterist. The format and typography as such as to make the bibliography both attractive and easy to use.

Faust, E. C. An Inquiry into the Prevalence of Malaria in China. *The China Medical Journal*, Vol. XL, No. 10, pp. 937-956, 4 figs, 1926.

The writer of this article goes into the early history of malaria in China and points out that the symptoms of clinical malaria were recorded in the Chinese medical annals, the *Neiching*, as far back as 2600 B.C. Many remedies were prescribed for malaria in the Chinese Herbal, including several tonics, of which arsenic was one. The first statistical records by Western physicians regarding the prevalence of malaria in China appear in the Medical Reports of the Chinese Maratime Customs, beginning with 1871. For several decades there has been abundant direct evidence of the heavy endemicity and epidemicity of malaria of the three known types in the Yangtze Valley and the more southern parts of China, while the disease in the north has been much less prevalent and its expression much more benign; with only occasional epidemics which have been due to unusual climatic conditions such as floods. It is still the commonest disease in the country, and the most serious cause of ill health among the Europeans in the East. After the discovery of the mosquito origin of malaria, interest in the disease on the part of physicians in China, seemed to decrease instead of increase as one would expect.

The disease as a health menace in China may be said to involve practically all of the Yangtze Valley, the southeast coastal provinces, and the regions of the southern boundary adjacent to Tonkin and Burma. There is also a focus of the disease in the Amur basin. A map of China and adjacent regions showing the place of collection of species of *Anopheles* mosquitoes is included. Twenty-nine species and two varieties are indicated but unfortunately the names have been so reduced in reproduction that they cannot be made out.

The dominant Anopheline in China is said to be *A. hyrcanus* var. *sinensis*, which has been collected from Hongkoug to Peking and from Chengtu to the Yangtze delta. There is no evidence, however, that this species is the actual predominant carrier in China proper, although it has been shown that it is capable of serving as the definitive host of all three species of *Plasmodium* in Formosa. All the species of *Anopheles* from South China are peculiarly Oriental with the exception of *A. hyrcanus* var. *sinensis*.

Clinicians in China, in general, believe the paddy fields to be the breeding place of malarial mosquitoes, but Dr. Faust points out that this may not be the case, and on the contrary that data from collections thus far point to a Culicine as the dominant rice-field mosquito. The breeding places of *Anopheles* mosquitoes in China are essentially unknown.

Rainfall and temperature have a definite bearing on the endemicity and epidemicity of malaria in China. A map is included which shows the monthly rainfall for representative localities in China. The author holds the view that "while the more tropical climate of South China is undoubtedly responsible for this high incidence, temperature and rainfall are directly correlated along the China coast, so that the rainfall curves serve as a very satisfactory guage within the limits indicated in determining the malaria index of a particular locality in China."

Anopheles pattoni, a new species, was recently described from North China. A list of 18 references is appended.

Faust, E. C. Preliminary Check List of the Mosquitoes of the Sino-Japanese Areas. *The China Medical Journal*, Vol. XL, No. 2, pp. 142 & 143, 1926.

Sixty-six species are listed, 28 of them of the Tribe Anopheline, 38 of the Tribe Culicini. Most of the species belong to the Oriental Faunal region, some to the Palearctic, and one each to the Nearctic and Australian.

Fronda, F. M., and **Gonzales, B. M.** Developing the Cantonese Chicken. *The Philippine Agriculturist,* Vol. 15, No. 8, pp. 481-485, 2 plates, 1927.

The Cantonese, a non-standard breed of poultry was introducded into the Philippines from near Canton, China, hence the name. The College of Agriculture of the University of the Philippines secured the original stock in 1916 from the Manila Bureau of Agriculture. The fowls were small and varied greatly in plumage and shape. The eggs-were small and the shell variable in color. Their only apparent good points were "very hardy and very resistant to disease." Beginning with a systematic mass selection and later inaugerating selection for egg production, a very satisfactory type of fowl has been developed. Unlike many other breeds of chickens the Cantonese responded very well indeed to the local environmental conditions and the native methods of feeding, care, and management. "Where the Cantonese has improved without further importation of these fowls to supply 'fresh blood,' the other imported breeds have failed." It remains hardy and feels at home under various conditions of environment,—in city, town, or in the country, and it also lends itself to intensive culture. The rate of increase in the number of eggs produced by the flocks at the College indicate that in the future "200-eggers" may be a common occurrence. The goal aimed at is the development of a breed of fowls well suited to tropical conditions. The Cantonese fowls are expected to become an important factor in the development of the poultry industry of the Philippines.

Galloway, B. T. The Search in Foreign Countries for Blight-Resistant Chestnuts and Related Tree Crops. *United States Department of Agriculture, Department Circular 383,* pp. 1-16, fig. 5, 1926.

This paper traces the introduction of chestnuts and related species into the United States from 1899 to the present time and discusses the known merits of the several introductions to date, stressing especially their bearing on the problem of chestnut blight disease. The *raison d'etre* of the paper is given in the last paragraph of the introduction and is herewith quoted:

> In view of the great interest in substitutes for our native chestnut that may prove able to withstand the blight and be utilized in breeding work, looking to the supplying of timber, tannin, and food, it has seemed desirable to bring together certain data bearing on the species already introduced or that may be introduced. This seems particularly necessary, inasmuch as there is considerable confusion and some misunderstanding as to the real merits of the introductions heretofore made.

Material was imported from China into the United States as early as 1899, and in 1901 considerable material was sent to America from Hankow and Ichang, China, by Dr. G. D. Brill. This, Mr. Galloway holds, may have been the first introduction into the United States of what afterwards became known as the Chinese hairy chestnut *(Castanea mollissima* Blume.) When the seriousness of chestnut blight was realized interest was stimulated in foreign explorations with the hope of discovering new forms that might be of use in meeting the situation. It was while engaged in this kind of investigational work that the late Frank N. Meyer, agricultural explorer of the Bureau of Plant Industry, United States Department of Agriculture, discovered the original home of the chestnut blight fungus to be in China. This was in 1913. The disease was found attacking the Chinese hairy chestnut and at the same time it was learned that his species of chestnut was at least somewhat resistant.

About two thirds of the paper is devoted to a discussion of chestnuts *(Castanea* spp.) and evergreen chinquapins *(Castanopsis* spp.) In the first group the above-mentioned Chinese hairy chestnut *(Castanea mollissima* Blume,) the European chestnut *(C. sativa* Miller,) the Chinese Timber Chinquapin *(C. henryi* (Skan) Rehder and Wilson,) Chinese dwarf chinquapin *(C. sequinii* Dode) and Japanese chestnut *(C. crenata* Sieb. and Zucc.) are discussed, while in the second group *(Castanopsis delavayi* Franchet, *C. hystrix* DC, and four unnamed species are discussed.

Considerable space is given to the discussion of *C. mollissima* which is perhaps the most important introduction. Of it the author says:

> There is little information at present that would encourage the belief that the Chinese hairy chestnut may be utilized as a substitute for our native species in the production of timber or for tanning purposes. As a possible source of a valuable food crop and perhaps poles, posts, and similar timber, *Castanea mollissima* seems well worthy of study and extension.

This species is said to offer promising material to those interested in breeding and selection work, and some valuable crosses have already been made.

C. henryi is recommended for breeding purposes and *C. sequini*, it is pointed out, may also prove useful for breeding work.

Notes are included on the habit, distribution, and culture of the several species of *Castanea* and *Castanopsis*, so there is information of interest and value other than that relative to blight-resistant considerations.

Gater, B. A. R. A Preliminary List of Food-Plants of Some Malayan Insects. *Department of Agriculture, Federated Malay States and Straits Settlements*, Bull. No. 38, pp. 1-95, 1926.

The information in this very useful bulletin was compiled from the Records obtained in the Entomological Laboratory from 1920 to 1926 by G. H. Corbett and B. A. R. Gater, during which time an investigation was conducted in order to learn of the phytophagous insects of Malaya, to secure life-history notes, to disseminate information concerning Malayan insects, and to form the basis for futher studies. The paper is divided into the following sections; Preface, Introduction, List of Insects, List of Plants, Miscellaneous Foods, References, and Index. The preface discusses the history of economic entomology in Malaya, the method employed in investigation, and other matter. In the introduction the position and climate of the Malay Peninsula, ecological notes, and brief economic notes are discussed. The economic notes include the more serious pests discussed family by family. In the 'list of insects' the insects are arranged under their orders and families, the species being arranged alphabetically within the families. Opposite of each insect name is a list of "food" on which it has been taken. In the 'list of plants' the plants are under their natural orders, arranged alphabeticaly within their orders, showing the insects recorded on them and the portion attacked. Brief notes are added where required and the family of each insect is given for easy reference. The plants are numbered consecutively, their numbers being referred to in the index. Finally, a list of miscellaneous foods not included in the plant list is given. This last includes beeswax, cheroots, cloth, carpets, copra, flowers, fruits, grasses, lac, decaying matter, paper, rope, wood, etc. The list of 32 literature references are to articles and bulletins published by the Department of Agriculture, Federated Malay States and Straits Settlement, in which details of insects referred to are given. The index covers the orders and popular names of plants mentioned in the lists.

This publication is useful to workers in China since not a few of the insects listed are species which also occur in China.

Ge, Lynn. Transmission of Typhoid Fever by Bedbugs. *The National Medical Journal of China.* Vol. 12, No. 1, pp. 62-93, 3 tables, 1926.

This paper gives the results of experiments which were made to ascertain whether or not bedbugs transmit typhoid fever. In the investigation, which lasted several months, sixty rats were used in a set of four experiments. Bedbugs which fed on infected rats and later on healthy rats caused 46.6 per cent infection in the healthy rats. The author of the paper is of the opinion that infection of the bedbugs takes place only when the blood they suck contains a large number of bacilli and also that numerous bugs must bite the healthy animal in order to infect it. The conclusions reached were: (1) typhoid fever can be transmitted by bedbugs, and (2) typhoid bacilli can be found from various parts of bedbugs.

Gee, N. Gist, Moffett, Lacy I., and **Wilder, G. D.** A Tentative List of Chinese Birds. *Bulletin of The Peking Society of Natural History*, Technical Series, No. I, part 1, pp. 1-144, 1926.

This publication, comprising the orders from Colymbiformes to Coraciformes is Bulletin No. 1 of the Peking Society of Natural History, founded in 1925. 574 species and subspecies are listed. Besides the actual list, the bulletin contains a prefatory note (relative to the Peking Society of Natural History,) an introduction (giving some historical matter concerning the ornithological literature of China), and a list of 40 references.

The area covered by this list is understood to mean the eighteen provinces of China proper, the Island of Hainan, East Tibet, Mongolia, East of the Altai Mountains and Manchuria, including the Amur and Ussuri River basins and the Island of Sakhalin now belonging to Russia and Japan, but properly belonging to the Manchurian faunal area.

Gudger, E. W. Fishing with the Cormorant in China. *The American Naturalist*, Vol. LX, No. 666, pp. 5-41, fig. 16, 1926.

In this article Dr. Gudger has in a very thorough way traced the practice of cormorant-fishing from very early times to within the last few years. Dr. Gudger points out that nearly every one who has travelled in China has written a book on his travels, and that practically every book of travels contains an account of cormorant-fishing. The many accounts he says, except for details, are essentially alike. The author does not quote or synopsize all of these but attempts to bring together all the oldest accounts and oldest figures, and then to bring in some modern accounts and finally some figures illustrating present-day scenes of this method of fishing.

In a book (1513) by Odoric of Pordenone (who spent three years in China somewhere between 1323 and 1328) is found the earliest printed account of fishing with the cormorant. Cormorant-fishing in China was already an old custom at this time and acording to Dr. Berthold Laufer of the Field Museum, Chicago, the practice "was established under the Sung dynasty (960-1298) and in Japan possibly a little earlier (end of 6th century.) The practice seems to have originated in Chekiang and Kiangsu and to have spread from there to other provinces."

Dr. Gudger gives the accounts of cormorant-fishing in chronological order until those of the year 1800 from which time the accounts are he says literally "too numerous to mention." From 1800 on he quotes from those only which give new data or have interesting illustrations.

Robert Fortune in his "*Ten Years Wanderings in the Northern Provinces of China*" (1847) seems to have been the first writer to discuss the question of rearing the cormorant in captivity.

The last literature quotation used by the author was taken out of its chronological sequence in order that he might use it as the closing account, for which he thought it especially fitting. It is an official description of the rearing, training, and care of the fishing cormorant, and bears the sanction of the Chinese Government. It was first published, according to Dr. Gudger, in the *Special Catalogue of the Ningpo Collection of Exhibits* (International Fishery Exhibition, Berlin, 1880) and has been published several times since then. This account is quite full and is well written. It maintains that certain places are noted for the excellence of their cormorants and that the most celebrated of all is T'anghsichen, a small town 50 *li* northwest of Hangchow where the people are believed to know a secret in cormorant rearing which gives them special success.

Henry, Augustine, and **McIntyre, Marion.** The Swamp Cypresses, Glyptostrobus of China and Taxodium of America, with notes on Allied Genera. *Proceedings of the Royal Irish Academy,* Vol. 37, Section B, No. 13, 1926.

This monograph is of special interest to those in China who are familiar with the Chinese "Water Pine," *Glyptostrobus pensilis* (水松). The work embraces the following headings with regard to *Glyptostrobus:* History, including an elucidation of the synonomy, Distribution and Habit, Botanical Characters, including a detailed description of the three distinct types of leaves, and Fossil Species. Then follows a full account of The Branchlets, Leaves, Flowers, and Cones of *Taxodium,* by way of making clear the botanical characters of the genus *Glyptostrobus.* A detailed comparison between the woods of *Glyptostrobus pensilis, Taxodium distichum, Sequoia sempervirens,* and *Wellingtonia gigantea* is then given. In addition to the 116 pages of text, the work includes eight plates, two of which are from photographs of the water pine and six are from drawings by Mrs. McIntyre, illustrating the botanical characters of *Glyptostrobus pensilis* and *Taxodium distichum,* and comparing the structure of the woods of these two trees and those of *Sequoia sempervirens* and *Wellingtonia gigantea.* There are 23 literature citations.

F. A. McClure.

Howell, A. Brazier. Contribution to the Anatomy of the Chinese Finless Porpoise Neomeris phocaenoides. *Proceedings of the United States National Museum,* Vol. 70, Art. 13, pp. 1-43, pl. 1, 1927.

This paper gives an account of the anatomy of *Neomeris phocaenoides* (Cuvier). The specimens studied were secured by F. R. Wulsin in 1924 and were labeled "Woosung, Kiangsu, China" and "Yangtze, Kiangsu, China." The author states that a thorough investigation of specialization for an aquatic existence among the Mammalia calls for a study of representatives of a number of orders, but inasmuch as there in insufficient material available for such study he offers this paper as a separate contribution. Besides the introduction the following headings are discussed: Historical, Material, External Features, Osteology, Myology, and Other Soft Parts. 14 text figures are included and 15 literature references are appended.

Hu, H. H. Further Notes on Chinese Ligneous Plants. *Journal of the Arnold Arboretum*, Vol. 6, No. 3, pp. 140-143, 1925.

Five new species are described and five new combinations proposed.

Kirk, Edwin. Tanaodon, a New Molluscan Genus from the Middle Devonian of China. *Proceedings of the United States National Museum*, Vol. 70, Art. 12, pp. 1-4, pl. 1, 1927.

Tanaodon louderbacki new species is the genotype and only known species of the new genus *Tanaodon*. *Tanaodon* belongs to the family Megalodontidae and is close to a new genus from the upper Silurian of Alaska. In general form the new genus bears a close resemblance to the Cyrtodontidae. The species is named for Professor George D. Louderback who collected several specimens of it in the Middle Devonian deposits of the Tung Kou District, Szechwan, China, in 1925. The type specimens are in the collection of the U. S. National Museum.

Merrill, E. D. Additions to our Knowledge of the Flora of Hainan. *Journal of the Arnold Arboretum*, Vol. 6, No. 3. pp. 129-140, 1925.

This contribution concerns plants collected in Hainan in 1920 by Mr. W. Y. Chun. Among the species discussed nine are new and one new name is used. The genera *Dacrydium*, *Phyllochlamys*, *Popowia*, *Orophea*, *Drypetes*, *Calpigyne*, *Apodytes*, *Lithosanthes*, and *Synthea* are recorded for the first time from China. The types of the new species are placed in the herbarium of the University of California.

Merrill, E. D. New Chinese Ligneous Plants. *Journal of Arnold Arboretum*, Vol. 8, No. 1, pp. 3-19, 1927.

Twenty-one new species (representing 19 genera and 17 families) are described, while two genera new to China are recorded. Several new names and new combinations are used. Most of the species were collected in the North River region in Kwangtung Province in 1924 on an expedition in which the National Geographic Society and Lingnan University (Canton Christian College) cooperated. The types of the new species collected on this expedition are in the United States National Herbarium.

McKelvey, Susan Delano. Syringa Rugulosa, A new Species from Western China. *Journal of Arnold Arboretum*, Vol. 6, No. 3, pp. 153 and 154, 1925.

Syringa rugulosa is described as new from Yunnan.

Nakai, T. Two new Genera of Bambusaceae with Special Remarks on the Related Genera Growing in Eastern Asia. *Journal of the Arnold Arboretum*, Vol. 6, No. 3, pp. 145-153, 1925.

Pleioblastus and *Indocalamus* are the two new genera. A generic key is given for ten genera. A number of new combinations are proposed.

Oldt, F. Night-Soil as Fertilizer. *The China Medical Journal*, Vol. XL, No. 11, pp. 1059-1070, 1926.

This is a paper which was read at the Public Health Section of the China Medical Association Conference held in Peking, September, 1926. The title might well have been "Nightsoil as Fertilizer from the Standpoint of Public Health." The material is given in a very condensed from and for the most part outlined. The author says the paper is the result of a desire on his part to sum up four years of work in order to see what has been accomplished and to interpret its significance, to see what new lines of investigation are opened up, and to outline a program for the continuance of the work. Considerable of the information has appeared in earlier papers by the same writer. The paper will well repay careful study on the part of biologists and physicians.

Oldt, F. Hookworm in Kwang Tung and Some Suggestions for its Eradication. *The China Medical Journal*, Vol. XL, No. 3, pp. 240-248, 1926.

This discussion is divided into two main sections of *Epidemiology* and *Eradication*. Under the first heading are discussed the topics of "Factors Concerned in Human Infestation," "Factors Favorable to Soil Infestation," and "Factors Unfavorable to Soil Infestation." Under the second heading the results of various experiments in treating nightsoil are given.

Both *A. duodenale* and *N. americanus* are found in Kwangtung province. Sex and age of humans are of no significance in determining infestation except as they determine who shall work in the fields. Hookworm in this province is essentially a rural health problem, with the people engaged in sericulture heading the list with a 70% infestation. The temperature, humidity, and type of soil of Kwangtung are all favorable factors to soil infestation. March to October is a very favorable season for the development of infective larvae in the soil.

What to do with the nightsoil is the heart of the whole problem of eradication. The discontinuance of the use of nightsoil as fertilizer would not solve the problem, for the matter of safe disposal would still exist. The remedy seems to be in some modification of the wet-storage method as now practiced by the farmers of South China. Hookworm eggs must be made to lose their viability in sufficient numbers to cease to be a health menace without reducing the fertilizing value of the nightsoil. Experiments of mixing nightsoil with some commercial fertilizers used by Chinese farmers showed:

> Nightsoil to which 25% ammonium sulphate was added became practically sterile in one week, with a strong probability of sterility occurring in one day. The same can be said of Chili nitrate and stone lime. The 25% gypsum mixture became practically sterile in two weeks. Like mixtures with ashes showed almost as good results as with ammonium sulphate.

Ammonium sulphate is commonly used by mulberry farmers. Both it and nightsoil are highly diluted with water before application, to the soil and some farmers use both on the same crops. There seems to be no good reason why the two should not be mixed up to 12% ammonium sulphate before dilution. Experiments using this mixture with soil indicated that such a mixture made a "safe" fertilizer one day after preparation as far as hookworm infestation is concerned. The results should, the writer points out, be tried out under actual field conditions, and comparative cost, fertilizing value, and effect on soil should be ascertained. [In *The China Medical Journal*, Vol. XL, p. 370, Dr. Oldt gives a bibliography of 8 titles relative to Hookworm in Kwangtung.]

Patton, W. S. Blood-Sucking Arthropods of Medical and Veterinary Importance in China. *The China Medical Journal*, Vol. XL, No. 6, pp. 543-553, and No. 7, pp. 603-612, 1926.

This is essentially a paper on Medical Entomology and is written in a non-technical way. It will certainly prove of interest and value to non-entomologist readers while notes on particular species of insects in China may be helpful also to the entomologists.

The opening paragraph gives us a historical note of interest and is quoted below:

> It is now fifty years since the late Sir Patrick Manson, then a young medical practitioner in Amoy, South China, made the epochal discovery that *Filaria bancrofti* undergoes its extracorporeal development in *Culex fatigans*, the common culicine mosquito of China. By this discovery Manson became the father of Medical Entomology and China the birthplace of this important subject.

The hope of stimulating interest in the subject of Medical Entomology, particularly among medical men and zoologists, is the purpose of this paper. Diptera, Siphonaptera, Rhynchota (Hemiptera), and Anoplura are the groups of insects discussed. Some general notes are given and then a mention made of those of the group that are blood suckers. Mites and ticks are discussed and finally some notes on collection and technique.

The names of the several species of Arthropods recorded as from China are herewith listed:

Diptera of True Flies

Of the "sandflies" *Phlebotomus pappatasii* is the carrier of "Sandfly" Fever. This fever (but not the insect) has been recorded from China. *Phlebotomus major* var. *chinensis*, *P. sergenti*, and *P. sinensis* have been collected in China, and further, the first named has been suspected of being the carrier of the parasite of kala azar in China.

Simulium equinum (buffalo gnat)

Tabanus ditaematus (gadfly or horse-fly)

Aphiochaeta scalaris which commonly causes myiasis in man and animals does not occur in North China but the author believes it occurs in South China.

Musca domestica (European species of House fly)
Stomoxys calcitrans
Haematobosca perturbans
Lyperosia exigua
Lucilia sericata
Chrysomyia megacephala
Gastrophilus intestinalis
Oestrus ovis
Hippobosca francilloni

Siphonapter or Fleas

Tunga langrangei
Xenopsylla cheopis
Ceratophyllus anisis

Hemiptera or True Bugs

Cimex lectularius (in North China) Bedbug
Cimex hemiptera (in South China) Bedbug

Anoplura or Sucking Lice

Pediculus humanus var. *vestimenti*
Pediculus humanus var. *capitis*
Phthirius pubis

ARACHNIDA OR TICKS AND MITES

Argas persicus

Major Patton mentions having collected a number of other insects but apparently they were not yet determined at the time he prepared these notes.

Sturtevant, A. H. Philippine and other Oriental Drosophilidae. *Philippine Journal of Science*, Vol. 32, No. 3, pp. 361-374, 1927.

This is a study of three Oriental series of Drosophilidae, from the Philippines, from Formosa, and from India. The author refers to two papers on the Palaearctic and Oriental Drosophilidae, by Dr. O. Duda, and says that they are so nearly complete that they must serve as the basis for any study of the Old World species. The author states the purpose of his paper to be, "To present a few notes on species that I have seen, correlate the new species here described with Duda's account, add a few observations based on examination of some of the type material at the British Museum, and introduce some modifications in the system, based chiefly on Malloch's work." Thirteen species and one variety are described as new. Only one species, *Drosophila melanogaster* Meigen, is recorded as from China. Its distribution is given as; Nungambankan, Madras, India, Peking, China.

Wilson, Ernest H. The Rhododendrons of Eastern China, the Bonin and Liukiu Islands and of Formosa. *Journal of the Arnold Arboretum*, Vol. 6, No. 3, pp. 156-186, 1925.

The author makes some general remarks on the flora of Bonin Islands, Liukiu Islands, Formosa, Hong Kong and China, and then takes up the matter of the Rhododendrons, of which he says the species found in the different regions are mostly local in distribution. From the whole territory under discussion some forty species are known, but certain parts of the area are but little known. In all 21 species of Rhododendrons are known from the mainland of eastern China, 14 of which have not been reported from elsewhere. Several new species are described and a number of keys to species included.

CHINESE DECAPOD CRUSTACEA (A Correction)

Mr. Gee requests us to say that the List of Decapod Crustacea published in the previous issue of the *Review* should have had his name signed to the introductory note only. As was stated in this note that list was kindly prepared at his request by the workers in this group at the U. S. National Museum as a preliminary or tentative list in order to aid and encourage those who were working in this group in China. Consent was given for its publication only as a tentative list and not as a final or complete one. The U. S. National Museum will be glad to receive materials representing the Crustacea of China and they will return promptly named specimens where several of a kind are sent.

ANNOUNCEMENT

Beginning with Volume V *The Lingnaam Agricultural Review* will be published quarterly and the name will be changed to *Lingnan Science Journal*, a name which more accurately indicates the field covered.

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THE LINGNAAM
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UNRECORDED PLANTS FOR KWANGTUNG PROVINCE

By E. D. Merrill
University of California.

While most of the species listed below have been reported from some part of China, I have found Kwangtung records for but few of them. As a matter of record I have, however, included in the paper a few additions to the Chinese flora which do not occur in Kwangtung. These are *Titanotrichum oldhamii*, *Phalaris canariensis*, *Nuphar minimum*, *Isachne polygonoides*, *Conandron ramondioides*, and *Brachyelytrum erectum*, with a note on *Ardisia japonica* Blume. The genera *Titanotrichum*, *Conandron*, and *Brachyelytrum* have hitherto not been recorded from China proper.

Messrs. Dunn and Tutcher* have urged the publication of new Kwangtung records, which is the *rasion d'etre* of this paper. In reference to publications on the Chinese flora as a whole, the Kwangtung-Hongkong region stands out as the one region that is reasonably well covered by a published flora, although there are of course numerous published lists of the floras of other provinces; many of these are, however, very unsatisfactory and most of them are very incomplete. It has seemed therefore worth while to list the species enumerated below because it adds twenty-one genera and sixty species to the list of those previously reported from Kwangtung Province. Genera new to the province are *Tricholaena* (introduced and naturalized), *Carpinus*, *Betula*, *Aphananthe*, *Bocconia*, *Bucklandia*, *Schizophragma*, *Malus*, *Erythroxylum*, *Euscaphis*, *Anneslea*, *Idesia*, *Lythrum*, *Nyssa*, *Monotropa*, *Gaultheria*, *Myrsine*, *Pycnostelma*, *Elscholtzia*, *Scrophularia*, and *Melampyrum*.

These new records are for the most part based on rather extensive collections made by the National Geographic Society Central China Expedition under the direction of F. R. Wulsin. The Kwangtung collections were made in collaboration with the Canton Christian College (now Ling Nan University), the actual collectors being To Kang Peng, Ts'ang Wai Tak, and Ts'ang Un Kin. The Wulsin Expedition material was all collected in the North River region, chiefly on Lung

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*Dunn, S. T. and W. J. Tutcher. Flora of Kwangtung and Hongkong (China). Kew Bull. Add series **10** (1912) 1-370.

T'au Mountain, near Iu. From the numerous additions to the Kwangtung flora it is evident that previous to this trip comparatively little collecting had been done in that particular region. The collections were divided between the Canton Christian College and the United States National Herbarium, half of the duplicates of each number being retained for distribution by the former institution and half by the latter. The largest and most complete sets are accordingly filed in the United States National Herbarium and in the herbarium of the Canton Christian College. The study set on which this paper is based is deposited in the herbarium of the University of California.

POLYPODIACEAE

LOXOGRAMME (Blume) Presl

LOXOGRAMME LANCEOLATA (Sw.) Presl Tent. Pterid. (1836) 215.

Grammitis lanceolata Sw. in Schrad. Journ. **1800**^{2} (1801) 18.
Polypodium loxogramme Mett. Polypod. (1857) 112, *pl. 3, f. 25.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12271, 12294* (Wulsin Expedition). On rocks in forests. Tropical Africa and Asia, its Malaysian and Polynesian distribution doubtful.

This seems clearly to be the form figured by Copeland* as representing the typical form of this species. Matthew records *Polypodium loxogramme* Mett. from Fokien, Hupeh, Formosa, and Korea, but undoubtedly more than one species is included, certainly *Loxogramme fauriei* Copel. The specimens cited above have the few, short, stout, costular sori characteristic of the species as originally described.

ASPLENIUM Linnaeus

ASPLENIUM BILLETII Christ in Bull. Sci. France et Belg. **23** (1898) 267 *t. 12, f. 4-5.*

Kwangtung Province, Fung Wan Hu, North River region, *Canton Christian College 12829, 12920* (Wulsin Expedition), July, 1924, among rocks. Yunnan and Kweichau Provinces, and northern Indo-China, new to Kwangtung Province.

POLYPODIUM Linnaeus

POLYPODIUM PEDUNCULATUM (Hook. et Grev.) Mett. ex Salmon Nomencl. Gefäss Krypt. (1883) 312.

Ceterach pedunculata Hook. et Grev. Ic. Fil. (1827) *t. 5.*

Kwangtung Province, Cha Uen Shaan, Chuck Tsz Haang, North River region, *F. A. McClure 13776,* January, 1926. In moist forested ravines. Northern India to Hupeh, Anhwei, Chekiang, and Kweichau Provinces in China, but not previously reported from Kwangtung.

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*Copeland, E. B. The genus Loxogramme. Philip. Journ. Sci. **11** (1916) Bot. 43-47, *pl. 1-4.*

19 GRAMINEAE

PHALARIS Linnaeus

PHALARIS CANARIENSIS Linn. Sp. Pl. (1753) 54.

Fukien Province, near Foochow, *F. P. Metcalf and T. C. Chang 953*, without notes. Certainly introduced, perhaps cultivated, but at any rate not previously recorded from China. A native of Europe, now widely distributed in temperate regions. Canary grass.

BRACHYELYTRUM Beauvois

BRACHYELYTRUM ERECTUM (Schreb.) Beauv. Agrost. (1812) 39.

Muhlenbergia erecta Schreb. Besch. Gras. **2** (1872-79) 139. *pl. 50.*

Anhwei Province, Huang Shan, *R. C. Ching 8558*, (det. Hitchcock), July 12, 1925, in forests at an altitude of about 1000 m.

The genus and species new to China. This is a record of special interest as it adds another species to the list of those common to north-eastern Asia and north-eastern North America.

ISACHNE R. Brown

ISACHNE POLYGONOIDES (Lam.) Doell in Mart. Fl. Bras. **2**^{2} (1877) 273.

Panicum polygonoides Lam. Encycl. **4** (1797) 472.

Chekiang Province, Suer Shan, Kei Hwa, *R. C. Ching 8974*, Sept. 1925. In open sandy places along streams at 650 m. altitude. New to China.

The specimen was identified by Prof. Hitchcock who considers this species to be distinct from the oriental *Isachne miliacea* Roth. to which it was reduced by Hooker. f. In any case Lamarck's specific name is the older. The species is widely distributed in tropical America, and Prof. Hitchcock states that the specimen cited above and *Merrill 462* from Culion, Philippines are the only oriental representatives of it that he has seen, and expresses the opinion that it is an introduced species in the Old World.

TRICHOLAENA Schrader

TRICHOLAENA ROSEA Nees Cat. Sem. Hort. Vratisl. (1835), Linnaea **11** (1837) Lit. Ber. 129, p.p., Fl. Afr. Austr. (1841) 17, p.p; Stapf in Dyer Fl. Capensis **7** (1899) 443.

Kwangtung Province, Chuenchow, Hongkong territory, *Canton Christian College 13156 Mackenzie*, "introduced, growing on open hillsides." Natal grass, widely distributed in tropical and south Africa, now rapidly becoming naturalized in other tropical and subtropical countries where it has been introduced for forage purposes.

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LILIACEAE

SMILAX Linnaeus

SMILAX PERFOLIATA Lour. Fl. Cochinch. (1790) 622; Chevalier in Bull. Econ. Indochine **21** (1918) 327.

Smilax ochreata C.DC. Monog. Phan. **1** (1878) 191. Norton in Sargent Pl. Wils. **3** (1917) 11.

Kwangtung, near Fung Wan, North River region, *Canton Christian College 12876* (Wulsin Expedition), July 15, 1924, with the local name *ma kap lak.* India to Yunnan, Indo-China, and Hainan, not previously recorded from Kwangtung proper.

The specimen is with mature fruit and clearly represents this species. Chevalier has given an ample description of Loureiro's species, and I believe that *S. ochreata* C.DC. represents the same species.

BETULACEAE

CARPINUS Linnaeus

CARPINUS LAXIFLORA (Sieb. et Zucc.) Blume var. **MACROSTACHYA** Oliv. in Hook. Ic. **20** (1891) *t. 1989.*

Kwangtung Province, Lung T'au Mountain, North River region, *Canton Christian College 12414* (Wulsin Expedition), June, 1924, local name *shan ap kung ts'ing.* The species in Japan, the variety in Hupeh and Szchuen Provinces, and if my identification is correct, also in Hainan.

No representative of the Betulaceae is recorded from Kwangtung Province by Dunn and Tutcher. What I take to be the same form as that recorded above has also been collected in Hainan, *McClure 9548, Chun 6590, 6726, 6755.* I also collected sterile material of an *Alnus* on Loh Fau Mountain.

BETULA Linnaeus

BETULA LUMINIFERA H. Winkl. in Engl. Pflanzenreich **19** (1904) 91.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12354,* June 4, 1924. In forests, local name *chu yuk pi.*

The identification is by Mr. Rehder. The species was previously recorded from Hupeh, Szechuan, and Kweichow. The genus is new to Kwangtung Province.

FAGACEAE

CASTANOPSIS Spach

CASTANOPSIS HYSTRIX A.DC. in Journ. Bot. **1** (1863) 182.

Kwangtung Province, Kam Ngau Haang, *Canton Christian College 13617 F. A. McClure,* November, 1925. A tree 6 to 8 m. high on dry slopes, local names *yui tsai, chui tsai.*

Eastern Himalayan region and the Khasia Mountains to Burma, Yunnan, Szechuen, and Fukien Provinces, China, but not previously recorded from Kwangtung.

CASTANOPSIS CAUDATA Franch. in Nuov. Arch. Mus. Paris II **7** (1884) 87 (Pl. David. 277).

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12036, 12547.* (Wulsin Expedition), May and June, 1924, that the local names *ma mi so* and *chau shu.* Kiangsi, Anhwei, and Chekiang Provinces; new to Kwangtung.

63

ULMACEAE

APHANANTHE Planchon

APHANANTHE ASPERA (Thunb.) Planch. in DC. Prodr. **17** (1873) 208.

Prunus aspera Thunb. Fl. Jap. (1784) 201.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12458* (Wulsin Expedition), June, 1924. In forests on the lower slopes of the mountain. Local name *tai ngau lak.*

No representative of the genus is credited to Kwangtung by Dunn and Tutcher* although Chung† records this species from the province. Japan and China, recorded from the provinces of Shantung, Kiangsu, Chekiang, Kiangsi, Hupeh, Szechuan, Kwangtung, and Yunnan.

CELTIS Linnaeus

CELTIS BIONDII Pamp. in Nuov. Giorn. Bot. Ital. n. s. **17** (1910) 252, *fig. 3.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12451* (Wulsin Expedition), June, 1924. A tree about 10 m. high, in forests, local name *sai hung ngau lak.* Kiangsi, Kiangsu, Szechuan, Chekiang and Anhwei Provinces, with varieties in Fukien, Yunnan and Kweichow, but not previously recorded from Kwangtung. This was identified by me as representing Pampanini's species, and Mr. Rehder concurs. It differs from the common *C. sinensis* Pers., in its longer pedicels and narrower nearly entire leaves.

NYMPHAEACEAE

NUPHAR Smith

NUPHAR MINIMUM (Willd.) Sm. Engl. Bot. (1790-1816) pl. 2292.

Nymphaea lutea Linn. var. *minima* Willd. Sp. Pl. **2** (1799) 1151.
Nuphar pumilum DC. Syst. **2** (1821) 61.

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*Dunn S.T. and W.J. Tutcher. Flora of Kwangtung and Hongkong (China). Kew Bull. Add. Series **10** (1912) 1370.

†Chung H.H. A catalogue of trees and shrubs of China (1924) 32.

Anhwei Province, Tsi Chi, Wu Yuan, *R. C. Ching 4601, (Nanking Univ. 8989)*, Sept. 4, 1925. In streams at an altitude of about 700 m. Northern Europe across Asia to Manchuria, but hitherto not recorded from China. *Nuphar borneti* Lév. and Van. from Kweichau is so inadequately described that no intellegent disposition of it can be made from the description alone.

LAURACEAE

NEOLITSEA (Bentham) Merrill

NEOLITSEA AURATA (Hayata) comb. nov.

Litsea aurata Hayata Mater. Fl. Formosa (1911) 246.
Tetradenia aurata Hayata Ic. Pl. Formosanrum **3** (1913) 167, **5** (1915) 174, *fig. 61 c.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12519* (Wulsin Expedition). In forested ravines. Formosa.

The specimen has very immature fruits, and at least closely approximates Hayata's Formosan species, the leaves being larger then described and rather slenderly acuminate.

MACHILUS Ness

MACHILUS ICHANGENSIS Rehd. & Wils. in Sargent Pl. Wils. **2** (1916) 621.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12261* (Wulsin Expedition). A tree about 12 m. high in forests.

This species has been recorded from Chekiang, Hupeh, Fukien, and Kwangtung Provinces, to which may be added Kiangsi *(Ip 1112)* and Anhwei *(Ling 7820)*. Other specimens, originally identified by me as *Machilus longifolia* Blume, are *Merrill 11297* Hang Chow, and *R. C. Ching 1806, 2368, 2467*, all from Chekiang Province.

PAPAVARACEAE

BOCCONIA Linnaeus

BOCCONIA CORDATA Willd. Sp. Pl. **2** (1799) 841.

Macleaya cordata R. Br. in App. Denh. and Clapp Trav. (1826) 218, in note.

Kwangtung Province, Lung T'au mountain, near Iu, North River region, *Canton Christian College 12602* (Wulsin Expedition), June, 1924. In ravines near streams.

This is recorded here merely as an additional genus and species to the Kwangtung flora. The species is common in central China.

HAMAMELIDACEAE

BUCKLANDIA R. Brown

BUCKLANDIA POPULNEA R. Br. in Wall. List (1832) no. 7414. Hook f. Fl. Brit. Ind. **2** (1878) 429.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12180* (Wulsin Expedition), in forested ravines, local name *ma t'ai ling;* Kau Haang-Taai, Chun Wong Mountain, *McClure 13384*, in ravines, local name *ma t'ai fa shue.* India to Yunnan, southward to Sumatra and Java, although Hallier f. maintains the Malayan form as specifically distinct under the name *Bucklandia tricuspis* (Miq.) Hall. f.

This is a large eastward extension of range for the genus, its only other Chinese record being Yunnan on the basis of specimens collected by Henry.

SAXAFRAGACEAE

HYDRANGEA Linnaeus

HYDRANGEA PANICULATA Sieb. in Nov. Act. Acad. Leop. Carol. **14** (1829) 490.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12173, 12631,* (Wulsin Expedition), May and July, 1924. In forested ravines, local name *pak fa tau.*

Recorded from Kiangsi, Fukien, Hunan, Kweichow, Chekiang and Anhwei provinces, and in Japan, but hitherto unknown from as far south as Kwangtung.

SCHIZOPHRAGMA Siebold et Zuccarini

SCHIZOPHRAGMA INTEGRIFOLIA Oliv. in Hook. Ic. **20** (1890) *pl. 1934.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12518* (Wulsin Expedition), June, 1924. A vine in forested ravines. Kiangsi, Hupeh, Szechuan, Hunan, and Kweichow Provinces, but no representative of the genus previously known from Kwangtung.

ROSACEAE

MALUS Linnaeus

MALUS FORMOSANA Kawakami in Bot. Mag. Tokyo **25** (1911) 145. *t. 4.* 1911.

Pirus formosana Kawakami et Koidzumi in Journ. Coll. Sci. Tokyo **30**^{1}: 100. 1911 (Hayata, Materials Fl. Formosa 100).

Kiangsi, Lu Shan, *Steward 4704*, det. Rehder; Anhwei, Wang Shan, *Ling 7727;* Chekiang, Chen Chiong, *Ching 1784, 1789;* Kwangtung, Mung Haang, *McClure 13400.* April, 1925, here cultivated for its edible fruits, local name *shaan cha.* Formosa.

Not previously recorded from China. All the specimens cited above are in fruit, and differ slightly among themselves as well as slightly from Formosan material representing the typical form of the species.

SORBUS Linnaeus.

SORBUS CALONEURA (Stapf) Rehder in Sargent Pl. Wils. **2** (1915) 269.

Micromeles caloneura Stapf in Kew Bull. (1910) 192, Curtis's Bot. Mag. **136** (1910) *pl. 8335.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12413,* June 7, 1924, near the summit of the mountain. Local name *shan tong li.*

Previously reported from Hupeh and Szechuan. On first studying this material I was inclined to consider it an undescribed form, but Mr. Rehder identified it with Stapf's species.

RUBUS Linnaeus

RUBUS ASPER D. Don Prodr. Fl. Nepal. (1825) 234.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12102* (Wulsin Expedition), May, 1924, with the local name *she p'au lak. McClure 12291* from Shaan Haang, with the local name *shaan p'o* is the same.

This species has been sunk as a synonym of *Rubus rosaefolius* Sm., but appears to be sufficiently distinct to warrant retaining it as a valid species. It is apparently of wide distribution in central and western China, as I have specimens from Chekiang, Fukien, and Kiangsi Provinces. India, Indo-China.

ROSA Linnaeus

ROSA GENTILIANA Lév. et Van. in Bull. Soc. Bot. France **55** (1908) 55.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12171, 12437* (Wulsin Expedition), May and June, 1924, with the local names *ma han lak* and *shan yat yat hung.* Hupeh, Szechuan, Kweichow, Chekiang, and Fukien Provinces, but not hitherto recorded from Kwangtung.

PRUNUS Linnaeus

PRUNUS SALICINA Lindl. in Trans. Hort. Soc. **7** (1830) 239.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12118* (Wulsin Expedition), May 26, 1924, cultivated. Identification by Mr. Rehder. Honan, Hunan, Hupeh, Szechuan, and Yunnan in China; India. More commonly known as *Prunus triflora* Roxb., which is a synonym of Lindley's species, the latter's specific name being the valid one.

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LEGUMINOSAE

BAUHINIA Linnaeus

BAUHINIA HUPEANA Craib in Sargent Pl. Wils. **2** (1914) 89.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12335* (Wulsin Expedition), June 3, 1924. In forested ravines; local name *pak mak t'ang.*

I originally referred this to Craib's species but later placed it under *Bauhinia glauca* Wall.; Mr. Rehder, however, identified it as *Bauhinia hupeana* Craib. Previously recorded from Hupeh and Szechuan.

ERYTHROXYLACEAE

ERYTHROXYLUM P. Browne

ERYTHROXYLUM KUNTHIANUM (Wall.) Kurz in Journ. As. Soc. Bengal **41**^{2} (1872) 294, **43**^{2} (1874) 135; Schulz in Pflanzenreich **29** (1907) 160, *fig. 31.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12287, 12528* (Wulsin Expedition), May and June, 1924. In forested ravines, local name *man li muk.*

This species extends from the Khasia Mountains and eastern Bengal to Burma, Tenasserim, and Yunnan *(Henry 10695, 12048, 12849).* The Kwangtung specimens cited above differ from this species as described in their relatively stouter, shorter fruits, the largest I have seen (immature) being but 8 mm. in length (11 to 14 mm. in Schulz's description). Unfortunately there are no flowers on my material, and the styles are fallen from the immature fruits. The stipule characters are those of this species. The genus is new to Kwangtung Province.

The only other species hitherto recorded from China is *Erythroxylum monogynum* Roxb., currently credited to China on the basis of an unlocalized specimen collected by Beechey. There is probably an error either as to the identification or as to the region cited, "China," as Schulz confines the species to India and Ceylon.

RUTACEAE

CLAUSENA Burman f.

CLAUSENA DENTATA (Willd.) M. Roem. Syn. **1** (1846) 44.

Amyris dentata Willd. Sp. Pl. **2**^{1} (1799) 337.
Clausena willdenovii Wight et Arn. Prodr. (1834) 96.

Kwangtung Province, near Fung Wan, North River region, *Canton Christian College 12880,* (Wulsin Expedition), July, 1924. India to western China and (?) Malaysia.

This species, as *Clausena willdenovii* Wight et Arn. has been reported from Yunnan. The Kwangtung specimen cited above agrees closely with the published descriptions and with Wight's figure which apparently represents the typical glabrous form. Willdenow's specific name is unfortunate, the leaflets being crenate or crenulate rather than dentate.

POLYGALACEAE

POLYGALA Linnaeus

POLYGALA LONGIFOLIA Poir. in Lam. Encycl. **5** (1804) 501.

Polygala leptalea DC. Prodr. **1** (1824) 325.

Kwangtung Province, without locality, *Tsoong 1083.* India to Indo-China, through Malasiya to Australia. This has been recorded by Dunn from China on the basis of *Henry 11244*, but the locality is not indicated and I have not seen Henry's specimen.

ANACARDIACEAE

RHUS Linnaeus

RHUS DELAVAYI Franch. in Bull. Soc. Bot. France **33** (1886) 466.

Kwangtung Province, near Fung Wan, North River region, *Canton Christian College 12883* (Wulsin Expedition), July 15, 1924, det. Rehder. Previously recorded only from Szechuan and Yunnan Provinces.

RHUS SYLVESTRIS Sieb. et Zucc. Fl. Jap. Fam. Nat. **2** (1846) 32.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12119* (Wulsin Expedition), May, 1924. On slopes, local name *ts'at tsz shu.*

A new record for Kwangtung Province, except for Engler's doubtful one "Canton (d'Yvan in herb. Deless.)?" Japan and Korea to Kiangsu, Chekiang, Kiangsi, Hupeh, and Fukien Provinces in China.

STAPHYLEACEAE

EUSCAPHIS Siebold and Zuccarini

EUSCAPHIS JAPONICA (Thunb.) Dipp. Handb. Laubholzk. **2** (1892) 480, *fig. 229.*

Sambucus japonica Thunb. Fl. Jap. (1784) 125.

Kwangtung Province, Lung T'au Mountain, near Iu and Yueng Uk, North River region, *Canton Christian College 12596, 12779*, (Wulsin Expedition), June and July, 1924. In forests near streams, local name *ts'at tai pak shu.*

Japan and Korea to Szechuan, Kweichow and Fukien, but not previously recorded from Kwangtung Province. Hayata, however, has described *Euscaphis konishii* Hay. from Hainan, although it is by no means certian that this Hainan form is specifically distinct from *E. japonica* Dipp.; I have seen no Hainan specimens.

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SABIACEAE

MELIOSMA Blume

MELIOSMA SINENSIS Nakai in Journ. Arnold Arb. **5** (1924) 80.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12256, 12572, 12673* (Wulsin Expedition), May to July, 1924. On forested slopes, local name *shan ts'at.*

Not previously recorded from Kwangtung Province. In making the preliminary identifications I referred this material to the closely allied *Meliosma oldhamii* Miq., but the specimens manifestly agree more closely with Nakai's species, if this is to be retained as distinct from *M. oldhamii* Miq.

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VITACEAE

VITIS Linnaeus

VITIS PENTAGONA Diels and Gilg in Engl. Bot. Jahrb. **29** (1900) 460.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12299* (Wulsin Expedition), May 31, 1924. In forested ravines.

The determination is by Mr. Rehder, the species being previously recorded from Kiangsi, Hupeh, and Yunnan. On first studying the material I was inclined to refer it to *Vitis lanata* Roxb., as recorded from Kwangtung Province by Dunn and Tutcher. Gagnepain,* however, confines Roxburgh's species to British India and states that the Kwangtung specimens referred to *Vitis lanata* Roxb. represent *Vitis retordi* Rom.

VITIS PIASEZKII Maxim. in Bull. Acad. Pétersb. **27** (1881) 461.

Kwangtung Province, Shiu chau, North River region, *Canton Christian College 12008* (Wulsin Expedition), July 21, 1924, in forests. Shensi, Honan, Hupeh, and Szechuan.

The determination is by Mr. Rehder who refers the Kwangtung specimen to the var. *pagnuccii* (Rom.) *(Vitis pagnuccii* Rom.*)* Gagnepain† reduces *Vitis pagnuccii* to *V. piasezkii* Maxim. as a straight synonym.

TETRASTIGMA Planchon

TETRASTIGMA OBTECTUM (Wall.) Planch. in DC. Monog. Phan. **5** (1887) 434.

Vitis obtecta Wall. List (1831-32) no. 6026.

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*Bull. Soc. Hist Nat. Autun **24** (1911) 30.

†Bull. Soc. Hist. Nat Autun **24** (1911) 29.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12086* (Wulsin Expedition), May 24, 1924, local name *lat li tang*.

Not previously recorded from Kwangtung Province, the species extending from India to Indo-China to Yunnan, Kweichow, Hupeh, and Szechuen. The number cited apparently represents the typical form approaching var. *glabrum* Gagnep.

No. 12152 from the same locality was originally identified by me as also representing this species, which it rather closely resembles, but the leaves are constantly trifoliolate, while the inflorescences are compound and cymose, not simply umbellate. Unfortunately only very immature fruits are available.

PARTHENOCISSUS Planchon

PARTHENOCISSUS LAETEVIRENS Rehder in Mitt. Deutsch. Dendr. Ges. **21** (1912) 190, Pl. Wils. **1** (1913) 590.

Kwangtung Province, Hau T'ung Mountain, North River region, *Canton Christian College 12905* (Wulsin Expedition), July 16, 1924. Previously known from Hupeh, Szechuan, and Kweichow. Identification by Mr. Rehder.

ELAEOCARPACEAE

ELAEOCARPUS Linnaeus

ELAEOCARPUS YENTANGENSIS Hu in Journ. Arnold Arb. **5** (1924) 230.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12262* (Wulsin Expedition), May, 1924. A tree in forests, local name *yeung shu fu*.

The specimen is just past the flowering stage, but agrees with a cotype of Hu's species in all essential characters. Previously known only from Kiangsi Province.

No. 12361 from the same locality possibly represents an undescribed species, but unfortunately the flowers are too young to warrant its further study at this time.

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THEACEAE

ANNESLEA Wallich

ANNESLEA FRAGRANS Wall. List (1829) no. 598, *nomen nudum*, Pl. As. Rar. **1** (1830) 5. pl. 5.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12238* (Wulsin Expedition), May, 1924. In forested ravines, local name *chuk tsit kwo*. Burma to the Malay Peninsula, Indo-China, and Formosa, but although recorded from China, by Dunn *(Henry 11591 c)* the locality not given; not previously recorded from Kwangtung Province.

FLACOURTIACEAE

IDESIA Maxim

IDESIA POLYCARPA Maxin. in Bull. Acad. Sci. St. Pétersb. III **10** (1866) 19. Hook. f. in Curtis' Bot. Mag. 111 (1885) pl. 6794.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12495, 12591, 12611* (Wulsin Expedition), June, 1924. In ravines near streams, locally known as *ma lang shu*.

A considerable southern extention of its range in China proper, the genus being previously unknown in Kwangtung Province. The species extends from Japan and Korea to Formosa, and in China is now known from the Provinces of Chekiang, Kiangsi, Hupeh, Honan, Szechuan, and Yunnan.

BEGONIACEAE

BEGONIA Linnaeus

BEGONIA PEDATIFIDA H. Lecomte in Fedde Repert. **7** (1909) 21.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12482* (Wulsin Expedition), in damp forests. Local name *shan hung in*.

A new record for Kwangtung Province, previously known from Kweichow, Szechuen, and Yunnan Provinces in China, and in Tonkin, French Indo-China.

LYTHRACEAE

LYTHRUM Linnaeus

LYTHRUM SALICARIA Linn. Sp.Pl. (1753) 446.

Kwangtung Province, near Fung Wan, North River Region *Canton Christian College 12828* (Wulsin Expedition), July, 1924. On rocky river banks.

This is a considerable southern extension of range, the species being widely distributed in central and northern China. The genus is new to Kwangtung Province.

NYSSACEAE

NYSSA Linnaeus

NYSSA SINENSIS Oliver in Hook. Ic. **20** (1891) pl. 1964; Wang. in Engl. Pflanzenreich **42**^{2} (1910) 10.

Kwangtung Province, Ling T'au Mountain, near Iu, North River region, *Canton Christian College 21508, 12651* (Wulsin Expedition) June and July, 1924. In forests. Local names *tai shui li* and *shui to it li*.

The genus is new to Kwangtung Province, this being a considerable southward extension of range. Kiangsi, Anhwei Hupeh, Szechuan?, and Yunnan Provinces.

PIROLACEAE

MONOTROPA Linnaeus

MONOTROPA UNIFLORA Linn. Sp. Pl. (1753) 387.

Kwangtung Province, Cha Uen Shaan, Wai Chung Peng, North River region, *F. A. McClure 13792,* January, 1926.

Widely distributed in the North Temperate Zone, but from China hitherto recorded only from Hupeh Province, although it is doubtless of very wide distribution in the republic.

ERICACEAE

RHODODENDRON Linnaeus

PHODODENDRON HOULSTONII Hemsl. and Wils. in Kew Bull. (1910) 110.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12667*, (Wulsin Expedition), July 5, 1924. In forested ravines. Identification by E. H. Wilson.

Rehder and Wilson, Pl. Wils. **1** (1913) 541, place this as a variety of *Rhododendron fortunei* Lindl., of Kiangsi; the species, or variety, here recorded from Kwangtung, was previously reported from Hupeh and Szechuan.

GAULTHERIA Kalm

GAULTHERIA CUMINGIANA Vidal Phan. Cuming. Philip. (1885) 184; Merr. Enum. Philip. Pl. **3** (1923) 246.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12577* (Wulsin Expedition), June, 1924. On slopes and in ravines. Formosa and the Philippines (Luzon to Mindanao).

This species has hitherto not been recorded from China although it is common at higher altitudes in the Philippines and occurs in Formosa. It seems to me to be very doubtful if this should be retained as specifically distinct from the Indo-Malaysian *Gaultheria leucocarpa* Blume *(G. punctata* Blume*)*.

MYRSINACEAE

MYRSINE Linnaeus

MYRSINE MARGINATA Mez in Pflanzenreich **9** (1902) 338.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 10273, 12570* (Wulsin Expedition), May and June, 1924. In forested ravines.

The type of this species was material collected by Faber "Prov. Kwang-Tung in den Ningpoo-Bergen," but the genus and species is not admitted by Dunn and Tutcher in their Flora of Kwangtung and Hongkong probably because the true locality is Ningpo, Chekiang Province; the specimens cited above agree closely with the description, the leaves however attaining a larger size than in the type, the largest being about 10 cm. long and 3 cm. wide.

ARDISIA Swartz

ARDISIA JAPONICA (Thunb.) Blume Bijdr. (1826) 690.

Kiangsi, Lu Shan, *Steward 4703;* Kiangsu, Bau Hwa Shan, *Steward 612;* Chekiang, Hangchow, *Steward 2898;* Anhwei. *Tsoong 1133.*

The specimens agree rather closely with each other and with the original description and figure of *Bladhia japonica* Thunb. The form figured by Mez, Pflanzenreich **9** (1902) 152, *fig. 23 A.-E,* at least as to the habit sketch is remote from Thunberg's species, presenting little in common with it. The habit sketch is manifestly taken from *plate 1892* of the Botanical Register supposed to represents *Ardisia odontophylla* Lindl. non Wall. Whether it represents *Ardisia odontophylla* Wall. Or not I cannot state, but it certainly does not represent *Ardisia japonica* (Thunb.) Blume.

SYMPLOCACEAE

SYMPLOCOS Jacquin

SYMPLOCOS MYRIANTHA Rehder in Sargent Pl. Wils. **2** (1916) 596.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12264* (Wulsin Expedition), May, 1924. A tree 5 m. high in forests. Western Szechuan.

The specimen above cited is in fruit and is hence not directly comparable with *Wilson 2550,* the type of Rehder's species which is in flower. The leaves are proportionally somewhat longer and narrower than in the type, while the lateral nerves are more deeply impressed on the upper surface and are distinctly more elevated on the lower surface. Flowering material may show that the Kwangtung form is specifically distinct.

STYRACEAE

ALNIPHYLLUM Matsumura

ALNIPHYLLUM FORTUNEI (Hemsl.) Perk. in Pflanzenreich **30** (1907) 91. *fig. 14.*

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12255* (Wulsin Expedition), May 29, 1924. A tree about 8 m. high in forests. Local name *tung t'o.*

A species previously know from Fukien, Szechuan, Kweichow, and Yunnan Provinces, the species in this small genus are not clearly defined. *Alniphyllum pterospermum* Mats. is recorded from Kwangtung Province, but the specimen cited above, although in fruit, clearly represents *A. fortunei* Perk.

ASCLEPIADACEAE

PYCNOSTELMA Bunge

PYCNOSTELMA CHINENSE Bunge in DC. Prodr. **8** (1844) 512.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12819* (Wulsin Expedition), July 11, 1924, without habitat notes but with the local name *liu tiu chuk*. Widely distributed in Japan and northern Asia (Manchuria to Dahuria) but hitherto not recorded from farther south than Hupeh Province. The genus is new to Kwangtung.

APOCYNACEAE

TRACHELOSPERMUM Lamaire

TRACHELOSPERMUM GRACILIPES Hook. f. Fl. Brit. Ind. **3** (1882) 668.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12309* (Wulsin Expedition), June 3, 1924. In forests, flowers white. India to Japan (fide Hooker). Not previously recorded from Kwangtung Province.

The specimen cited apparently represents a variety or form of Hooker's species. The flowers are slightly smaller than in *T. gracilipes* Hook. f. var. *cavaleriei* Schneider, but the vegetative characters conform closely and the tips of the anthers are somewhat exserted. Schneider's variety is recorded from Hupeh and Kweichow Provinces.

LABIATAE

ELSCHOLTZIA Willdenow

ELSCHOLTZIA CRISTATA Willd. Sp. Pl. **3** (1800) 29.

Kwangtung Province, Lung T'iu, *McClure 13145,* December 5, 1924. Along roadsides. India to Siberia and Japan naturalized in northern Europe, widely distributed in central and northern China, this record being a large southern extension of its known range. The genus is new to Kwangtung Province.

GESNERACEAE

TITANOTRICHUM Solerader

TITANOTRICHUM OLDHAMII (Hemsl.) Solerader in Ber. Deutsch. Bot. Gesellsch. **27** (Sept. 1909) 393, 400; Stapf in Hook. Ic. **30** (1911) *t. 2936.*

Rehmannia? oldhamii Hemsl. in Journ. Linn. Soc. Bot. **26** (1890) 194.
Matsumuria oldhamii Hemsl. in Kew Bull. (Nov. 1909) 361.

Fukien Province, Yenping, *H. H. Chung 2910,* August, 1924. In shaded ravines. The genus is new to China proper.

A duplicate of this was sent to Kew and was reported upon by Mr. Hutchinson as follows: "It agrees with the genus *Titanotrichum*, Solereder, figured in Hooker's Icones Plantarum *t. 2936.* It comes remarkably close to the only known species, *T. oldhamii* Solereder, hitherto recorded only from Formosa and is perhaps not distinghishable from that plant. It is very interesting to find the species in the province immediately opposite to the island."

A rather critical comparison of the specimen with the figure and descriptions, and with Formosa material *(Nakahara 124)* convinces me that this Fokien form is not specifically distinct from the Formosan one.

CONANDRON Siebold et Zuccarini

CONANDRON RAMONDIOIDES Sieb. et Zucc. in Abhandl. Akad. München **3** (1840) 730, *t. 3. f. 1* (Fl. Jap. Nat. **2**: 730.); Clarke in DC. Monog. Phan. **5** (1883) 61.

Anhwei Province, Wu Yuan, *R. C. Ching 8853,* August 16, 1925 on shaded water dripping cliffs at 800 m. altitude, common. The first record of this monotypic genus from China, it previously being known only from Japan and Formosa.

SCROPHULARIACEAE

VERONICA Linnaeus

VERONICA JAVANICA Blume. Bijdr (1826) 742.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12012* (Wulsin Expedition), May 22, 1924. Northern India to the Riu Kiu Archipelago and Java, not hitherto recorded from China proper. The identification is by Mr. S. T. Dunn at Kew.

SCROPHULARIA Linnaeus

SCROPHULARIA NINGPOENSIS Hemsl. in Journ. Linn. Soc. Bot. **26** (1890) 178.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12910* (Wulsin Expedition), July, 1924, with the local name *tai po she.*

No representative of the genus has hitherto been recorded from Kwangtung Province. The specimen conforms closely with the description, type from Ningpo, Chekiang Province, and with specimens from Anhwei and northern Fukien.

MELAMPYRUM Linnaeus

MELAMPYRUM ROSEUM Maxim. Prim. Fl. Amur. (1859) 210, 475.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12415* (Wulsin Expedition), June, 1924. On grassy slopes.

The genus is new to Kwangtung Province, the species being of very wide distribution, extending from Japan and Korea to Manchuria, southward and westward to Chekiang and Yunnan.

COMPOSITAE

CONYZA Linnaeus

CONYZA VISCIDULA Wall. List (1831) no. 3006, *nomen nudum*, DC. Prodr. 5 (1836) 383.

Kwangtung Province, Lung T'au Mountain, near Iu, North River region, *Canton Christian College 12440* (Wulsin Expedition), June, 1924, in ravines near villages. India to Formosa, through Malaysia to tropical Australia and New Caledonia, but not hitherto recorded from China.

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THE COCCINELLIDAE OF SOOCHOW.*†

By Hsin-Chih T'ao

Soochow University.

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*Contribution from the Biological Laboratory of Soochow University. This problem was suggested by and carried on under the direction of Professor Chenfu F. Wu, to whom acknowledgment is due for helpful suggestions and kindly criticisms. The writer is also indebted to Mr. H. S. Barber of the Bureau of Entomology, U. S. Department of Agriculture, for his kindness in making the specific indentifications.

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INTRODUCTION

On account of their predaceous habits on the plant lice, the ladybird beetles have become more and more interesting to the Economic Entomologists, but so far very little has been worked out in their external and internal structural characters as well as their life habits. In this work fifteen local species have been studied and one of them, *Coelophora swinhoii* Crotch, has been chosen as the type for an intensive study to illustrate the characters of Coccinellidae in general. The work was carried on from May 1924 to January 1926 and the results, herewith presented in this paper, are discussed in four divisions: (1) External Morphology, (2) Internal Anatomy, (3) Ethology and (4) Taxonomy.

The special methods and technique employed in this study are given at the beginning of each division and the important references are given in the appended bibliography. In all cases, the body and appendages of the beetles and their larvae are described in a normal position and all the drawings were made to scale on coordinate paper with the aid of an eye-piece micrometer in the miscroscope.

I. EXTERNAL MORPHOLOGY

The adult of *Coelophora swinhoii* Crotch herewith described is hemispherical in shape and black in color with two prominent red spots on the fore wings or elytra. The head is small, concealed under the prothorax and provided with one pair of antennae, two large compound eyes and the mouth parts fitted for biting. Each of the three thoracic segments bears a pair of legs and the meso-and metathorax, each bears a pair of wings. The first pair of wings is modified into sheath-like elytra, which at repose cover the mesothorax, metathorax, and abdomen. The abdomen consists of eight simple segments. The female can easily be distinguished from the male by the larger size of the body and by the black labrum. The metamorphosis is complete and there are four instars in the larval development.

For the study of external structures, specimens are killed and preserved directly in 95% alcohol. The binocular microscope is used for making dissections and drawings are made on coordinate paper with the aid of cross-section ocular micrometer. For gross dissection, the specimen is pinned down to a layer of paraffin in a Syracuse watch crystal and completely submerged in alcohol. A pair of minuten nadeln inserted on two match sticks are used for needles in micro-dissection.

A. The Head

1. *The Sclerites of the Head (Figures 9, 10 and 14).*

(a) THE EPICRANIUM. The vertex, the occiput and the genae are fused together into a single piece forming the main portion of the head capsule. The stem of the Y-shaped epicranial suture or the coronal suture expands indistinctly from the occipital foramen upward and forward along the median line to near the center of the dorsal surface of the head where it branches into two frontal sutures which proceed cephalo-laterad to the compound eyes. The frontal sutures become more and more indistinct as they approach the compound eyes.

(b) THE FRONT. The front is a large sclerite, situated between the compound eyes, bounded by the vertex behind, and separated from the clypeus in front by a clypeal suture.

(c) THE CLYPEUS. The clypeus is a narrow quadrangular sclerite, light brown in color and separated caudally from the front by the clypeal suture and cephalally from the labrum by the clypeo-latral suture. It is subdivided into the anteclypeus and the postclypeus by a transverse suture.

(d) THE ANTENNAL SCLERITES. At the base of each antenna on the cephalo-lateral border of the head, there is an annular antennal sclerite which is light brown in color and not chitinized.

(e) THE MANDIBULAR SCLERITES. Below each antennal sclerite, there is a triangular mandibular sclerite or the trochantin of the mandible. It receives the condyle of the mandible with an invaginated socket.

(f) THE GULA. The gula is a T-shaped sclerite situated at the middle on the ventral side of the head. The stem of the T has fused with the epicranium and can only be distinguished by slight depressed lines. It forms the base for the articulation of the maxillae and labium.

(g) THE JUGULAR SCLERITES. The head is joined to the prothorax by a thin membranous neck on each side of which there is a weakly chitinized jugular sclerite.

2. *The Eyes (Figures 9 and 10).*

The Compound Eyes. Two large and prominent compound eyes are located on the cephalo-lateral margin of the head. As the head is inserted into the prothorax the upper and outer parts of the eyes are concealed by the prothorax.

3. *The Appendages of The Head (Figures 4 to 8).*

(a) THE ANTENNAE. The antennae are light brown in color, 11-jointed, and inserted a little below and slightly in front of the eyes. They are clavate in shape and pubescent all over. The scape is the largest of all the segments. The pedicel is of nearly the same length as the segments of the funicle. The club consists of three segments which are larger than the preceeding ones.

(b) THE LABRUM. The labrum or the upper lip is a simple, convex and chitinized sclerite, pubescent all over, attached to the distal end of the clypeus and separated from the latter by the clypeo-labral suture.

(c) THE MANDIBLES. The mandibles are heavily chitinized and each provided with a pointed tooth at the distal end. Beneath this tooth and on its inner surface there is another smaller tooth. There is also a molar surface on the proximal inner surface of the mandible. Caudo-laterally it is articulated by a condyle to the mandibular sclerite, and caudally it is connected with the tentorium by a bundle of mandibular muscles.

(d) THE MAXILLAE. Each maxilla is composed of five primary parts which are the cardo, stipes, palpifer, galea and lacinia. The heavily chitinized triangular-shaped cardo is the basal part which forms the articulation of the maxilla. The stipes is also triangular in shape, chitinized, and joined to the cardo with its caudal margin. The palpifer is fused with the stipes and bears a maxillary palpus of five segments which enlarge gradually towards the tip. The galea is borne on the inner margin of the stipes and is subdivided into the subgalea and galea proper. The lacinia is attached to the inner side of the subgalea and is provided with a bifid digitus at its tip and a row of bristles on its own inner margin. All the parts of the maxilla are pubescent. The galea proper and the terminal segment of the palpus are provided with sense papillae.

(e) THE HYPOPHARYNX. The hypopharynx is weakly chitinized and is situated on the dorsal surface near the middle of the labium.

(f) THE LABIUM. The labium consists of three principle parts which are the submentum, the mentum and the ligula. The submentum is heavily chitinized being the basal and the largest part of the labium. The mentum is joined to the cephalic border of the submentum. The ligula is formed by the fusion of the glossae, paraglossae, and a pair of palpigers; each palpiger bears a 3-segmented palpus. The palpi are pubescent all over and the terminal segments of the palpi together with the cephalal margin of the ligula are provided with sense papillae.

B. The Thorax

(Figures 11 to 14)

The thorax consists of three segments, the prothorax, the mesothorax and the metathorax, all of which except the prothorax are covered by the elytra. On the sides there are two pairs of spiracles, one between the pro- and meso- and the other between the meso- and metathorax.

1. *The Prothorax.*

(a) PRONOTUM. All the tergal sclerites of the prothorax are completely fused together to form a single piece, the pronotum. It is convex in shape, highly chitinized, and with smooth margins. The central portion of the pronotum is black while the lateral margins are white. The pronotum of the larva is not chitinized but provided with several bristles on its dorsal ridged surface.

(b) PROPLEURA. The episternum and epimeron on each side are fused togethter to form a single piece, the propleurum, that lies on the side of the prosternum.

(c) PROSTERNUM. The sternum is T-shaped and is bounded on both sides by the propleura. The stem of the T proceeds backward so that its tip fits into the furcal pit on the mesosternum.

2. *The Mesothorax.*

(a) MESONOTUM. The mesothorax is closely fused with the metathorax and the greater part of its dorsal surface is concealed either by the pronotum or by the elytra, except a triangular chitinized piece, the scutellum. The prescutum is quadrangular in outline and concealed by the pronotum. The scutum is a transverse sclerite behind the prescutum and is divided into two parts by the median suture. The scutellum is the exposed triangular sclerite at the base of the elytra, and has been cephalized to lie on top of the prescutum. The postscutellum is a narrow transverse sclerite that lies behind the scutum. The scutum is produced at its cephalo-lateral corners into the wing process for the articulation of the elytra.

(b) MESOPLEURA. The pleurum of the mesothorax on each side is partly turned under to form part of the ventral surface of the thorax. It consists of an episternum and an epimeron, each of which is subdivided so as to form the four pleural sclerites; the anepisternum, the katepisternum, the anepimeron and the katepimeron. Only the katepisternum and parts of the anepisternum and katepimeron can be seen from the ventral side. The anepimeron is a large triangular piece

that lies partly under the anepisternum and anepimeron of the metathorax. The anepisternum is produced cephalo-dorsad to form the wing process of the elytra while the katepisternum and katepimeron are produced caudo-mesad to form the coxal process of the middle leg.

(c) MESOSTERNUM. The mesosternum consists of a single T-shaped sclerite with a furcal pit at the middle of its anterior margin.

3. Metathorax.

(a) METANOTUM. The metanotum, like the mesonotum, is strongly chitinized It is also divided into four parts, the prescutum, the scutum, the scutellum and the postscutellum. The prescutum consists of two triangular parts that lie partly above the scutellum which is a large and more or less quadrangular piece, that has cephalized to lie immediately behind the prescutellum. The two parts of the scutum are separated by the forwardly produced scutellum and are therefore pushed laterad to lie on the sides of the latter. Each part of the scutum is again partially divided into two by an incomplete suture. The postscutellum is a single narrow piece that lies transversely behind the scutellum. The scutum on each side is produced cephalo-laterad to form the anterior notal wing process and caudo-laterad to form the posterior notal wing process for the articulation of the hind wing.

(b) METAPLEURA. Like the mesopleurum, the pleurum of the metathorax on each side is also turned under, and is also composed of an episternum and an epimeron which are divided to form the four pleural sclerites. In the metathorax, however, only the katepisternum and part of the katepimeron can be seen from the ventral side. The anepisternum and the anepimeron together are produced cephalo-dorsad to form the wing process of the hind wings while the katepimeron alone is produced caudo-mesad to form the coxal process of the hind leg.

(c) METASTERNUM. The sternum of the metathorax is much larger than that of the mesothorax and is triangular in shape, divided into two parts by a median suture.

4. The Articular Sclerites of The Legs (Figures 12 and 14).

The proximal segment of each leg, the coxa, fits into the coxal cavity and is articulated with the body by two sclerites; an antecoxal piece on the cephalo-laterad border of the coxal cavity and a trochantin on the side of the coxal cavity. In the metathorax, however, the antecoxal piece is a narrow transverse sclerite on the anterior margin of the coxal cavity.

5. *The Articular Sclerites of The Wings (Figures 14 to 16).*

(a) THE CONDYLE OF THE ELYTRA. In the mesothorax the elytra is articulated by a condyle to the notal wing process on the scutum and to the wing process of the anepisternum of the mesothorax.

(b) THE OSSICLES. The ossicles are small sclerites at the base of each hind wing on the dorsal surface. The proximal one is the notopleural ossicle articulating distad with the base of the subcosta and ventrad with the anterior notal wing process. The second sclerite is the median ossicle, articulating proximad with the notopleural ossicle distad with the base of the radius and ventrad with the pleural wing process. The third sclerite is the adanal ossicle articulating distad with the base of the anal veins and caudad with the posterior notal wing process.

6. *The Legs (Figures 17 and 18).*

Each leg consists of five distinct and heavily chitinized divisions which are pubescent all over.

(a) THE COXA. The coxa is the proximal division of the leg and is provided with a groove to receive the trochanter and the base of the femur.

(b) THE TROCHANTER. The trochanter is the second and smallest division, being triangular in shape.

(c) THE FEMUR. The femur constitutes the third and heaviest division and is convex above and compressed on the sides.

(d) THE TIBIA. The tibia forms the fourth division, being long, slender, and three-sided. It is provided with a pair of tibial spurs at its distal end on the ventral side.

(e) THE TARSUS. The tarsus is the last division of the leg, consisting of three segments. The first and second segments are subequal in length and are each provided distally with a spongy pubescent pad on the ventral side. The third segment is much longer then the rest and is inserted near the proximal part of the second segment on the dorsal suface. It is also partly received into a groove on the dorsal surface of the second segment. It bears a pair of simple claws, each of which is provided with a tooth at base.

In the larval leg there are only four segments which are pubescent all over. All except the proximal one are very slender. There is no trace of segmentation in the tarsus and the last segment bears a pulvillus and a single claw.

7. *The Wings (Figures 1, 15 and 16).*

The front wings become thickened and are modified into a pair of strongly chitinized elytra. Each is convex in shape and black in color with a nearly rounded red spot at the center. The outer margin of the elytron is folded under to form the epipleurum which is widest in front and gradually tapering toward the posterior end. A knob-like condyle at the anterior border of the elytron forms its articulation to the mesothorax. The hind wings are large, membranous and folded under the elytra at repose. Each is fringed with minute hairs on its outer and inner margins. Near the base of the wing on the inner margin there is formed a notch, the axillary incision. The area of the wing membrane between the axillary incision and base is called the posterior lobe of the wing.

8. *Venation of the Wings (Figure 16).*

The costa is situated on the costal margin and extends distad for only a short distance. Immediately behind the Costa, the Subcosta and Radius arise together and are connected with the Costa by the humeral cross vein. They soon separate and then unite again, proceeding distad to end abruptly at the middle of the costal margin. In the apical area of the membrane there can be found portions of R_1 and R_3, whose connections with the stem of Radius have been atrophied. The stem of Media arises from the Radius near the base and extends a little caudad to fuse with the Cubitus, thus loosing its connections with its branches. M_1 extends from about the center of the wing to the outer margin. M_4, the so-called medial recurrent vein, arises a little proximad of the origin of M_1 and extends disto-caudad to unite with the Cubitus. The Cubitus is unbranched and extends from a little behind the origin of C and R to about the middle of the posterior margin of the wing. The first anal vein is atrophied. The second and third anal veins arise together behind the origin of Cubitus, and extend separately to near the axillary incision where they are united by a cross vein. The cell thus formed by the second and third anal veins is called the basal anal cell.

9. *The Folding of The Wings.*

The wing is folded obliquely and transversely at the base so that the anal area is folded under. In the distal half of the wing there are altogether four folds; the first and third ones being downward folds while the second and fourth are upward folds. Thus the folded wing is completely concealed under the elytron at repose.

C. The Abdomen

(Figures 19 to 24)

1. *The Segments of the Abdomen.*

In the larva the abdomen consists of ten weakly chitinized but spined segments which are typically ring-like. Besides the two pairs of spiracles, one between the pro-and mesothorax and the other between the meso-and metathorax, there are eight pairs of spiracles on the sides of the abdomen, one on each of the first eight segments. The number of abdominal segments is reduced to eight in the pupa and adult.

The abdomen of the adult is dorso-ventrally compressed, composed of eight distinct segments and provided with five pairs of spiracles on the tergites of the first five segments near the lateral margins. Each segment consists of a tergite and a sternite which are united on the sides. The sternites are much more chitinized than the tergites. On the ventral side the first and second segments are separated by the hind coxal cavities, leaving only the sternite of the second segment reduced to a very small sclerite between the two coxae. The sternite of the third segment is greatly produced forward at the middle. In the eighth segment the tergite and the sternite do not meet on the sides.

2. *The Genitalia.*

(a) THE MALE GENITALIA *(Figures 21 and 22).*

(1) SUPRA-ANAL PLATE. Behind and concealed beneath the eighth tergite is a chitinized sclerite, the supra-anal plate. It is rounded posteriorly and is pubescent on the under surface of the posterior margin.

(2) THE SUB-ANAL PLATES. On each side of the supra-anal plate, there is a smaller sclerite, the subanal plate. This can be best seen from the side and can also be seen with the supra-anal plate from below.

(3) THE PENIS. The penis is a very long chitinized spear-shaped process, enclosed in a chitinized sheath. At time of copulation, the penis is protruded together with the sheath and may extend much beyond the tip of the sheath which terminates in a sharp up-curved spine.

(4) THE CLASPERS. On the sides of the penis there is a pair of long clylindrical claspers which are chitinized, down-curved and provided with long hairs at tip. At time of copulation, they together with the sheath of the penis, clasp the seventh and eighth sternites of the female.

(b) THE FEMALE GENITALIA *(Figures 23 and 24).*

(1) SUPRA-ANAL PLATE. Beneath and completely concealed by the eighth tergite is a small narrow chitinized sclerite, the supra-anal plate, which can only be seen from below when the genitalia is protruded.

(2) THE SUB-ANAL PLATES. On the ventral side of the abdomen, completely hidden by the seventh and eighth sternite is a pair of chitinized sub-anal plates.

(3) THE VAGINAL VALVES. The paired vaginal valves lie between the two sub-anal plates and guard the female genital opening. They are chitinized and pubescent at tip. At time of copulation they are protruded a little beyond the eighth sternite and they serve to clasp the penis.

II. INTERNAL ANATOMY

For gross dissection and histology, newly molted larvae, pupae and adults are used because the chitinization of their integument is yet very little. When still alive, they are injected with warm Diedrich's Solution (40% Formalin, 12 cc.; 95% alcohol, 30 cc.; glacial acetic acid, 2 cc.; distilled water, 60 cc.); by inserting the canula into the abdominal cavity. They are then kept in the same solution for 24 hours. After that they are carried through a series of alcohol from 70% to 95%, being left 3 hours in each.

A. Digestive System

(Figures 25 to 32)

The alimentary canal is a simple tube running through the center of the body cavity and making a half loop in the posterior half of the abdomen. It is divided into three main divisions: the fore-intestine, the mid-intestine and the hind-intestine.

1. The Stomodeum.

The stomodeum or the fore-intestine is the anterior third of the alimentary canal, and it consists of the phyranx, and the oesophagus which passes through the occipital foramen to join the mesenteron in the anterior part of the prothorax. At its junction with the mesenteron, the oesophagus invaginates into the latter to form the oesophageal valve.

2. The Mesenteron.

The mesenteron or mid-intestine is the largest and longest division of the alimentary canal. It extends in the larva to the seventh, in the pupa to the fifth and in the adult to the fourth abdominal segment. Posteriorly it continues into the proctodeum without marked differentiation.

3. *The Proctodeum.*

The proctodeum or the hind-intestine constitutes the third division of the alimentary canal and is composed of the small intestine, the large intestine and the rectum. The small intestine or the ileum follows the mesenteron and forms a V-shaped loop before opening into the large intestine or the colon. The colon has a diameter twice as that of the ileum, and it gradually narrows down posteriorly to join the rectum which opens to the exterior through the anus.

4. *Histology of The Alimentary Canal (Figures 26 to 32).*

(a) THE OESOPHAGUS. The wall of the oesophagus is made up of four layers. The thick circular muscles are on the outside, and the very thin chinitized intima lines the inside. Between these two is the epithelial layer which is thrown into six irregular longitudinal folds and is lined with a basement-membrane on the outer surface where it joins the circular muscles.

(b) THE OESOPHAGEAL VALVE. The oesophageal valve is formed by the invagination of the oesophagus into the anterior end of the mesenteron. The epithelial cells of the oesophagus are small and narrow, and the peritrophic membrane arises from the junction of the oesophagus and the mesenteron. There are several layers of larger epithelial cells at the anterior end of the mesenteron.

(c) THE MESENTERON. In the mesenteron, there is no chitnized intima but the peritrophic membrane suspends in the middle as a tube. The epithelial cells are columnar in structure with distinct nuclei. There are two layers of muscles, the longitudinal and the inner circular.

(d) THE ILEUM. The epithelial cells are thrown into six deep longitudinal folds and are lined with an intima. Three layers of muscles can be located; the ental longitudinal, the ectal circular and the ectal longitudinal.

(e) THE COLON. The epithelium forms six low folds with an intima lining. The cells are large and glandular in structure with large nuclei. There is only one layer of circular muscles on the outside.

(f) THE RECTUM. Inside of the very thick layer of circular muscles, the epithelium forms six deep rectal folds with cubical cells. It is lined on the inside by the intima.

B. Excretory System

(Figures 25 and 33)

The excretory system consists of ten malpighian tubules which are long, cylindrical and opaque white in color. They are attached by one end to the alimentary canal. Six of them are attached in a circle around the junction between the mesenteron and the ileum and four of them in another circular row between the ileum and the colon. Their free ends extend irregularly in the body cavity as far forward as the metathorax. Some of them may extend backward irregularly.

The malpighian tubules are formed by the invagination of the proctodeum. Each of them in cross section shows that the wall is made up of four large cells with large nuclei. These cells are thrown into four regular folds, being lined on the outside by the peritoneal membrane.

C. Nervous System

(Figures 34 to 36)

The central nervous system of the larva consists of a supra-oesophageal ganglion, in the head above the alimentary canal, a sub-oesophageal ganglion also in the head below the oesophagus, three thoracic ganglia and eight apparent abdominal ganglia, the last one of which being a fusion of three ganglia. In the pupa and adult, the last seven apparent abdominal ganglia become cephalized and fused into one to lie in the second abdominal segment.

1. *The Supra-oesophageal Ganglion and its Nerves.*

In the larva the supra-oesophageal ganglion or the brain lies transversely dorsad of the oesophagus in the head near the anterior border. It consists of two hemispheres closely fused together along the meson with a median constriction. The three pairs of nerves are as follows: (1) the antennal nerves extending from the cephalal borders of the hemispheres to innervate the antennae; (2) the clypeo-labral nerves arising from the cephalo-mesal borders of the hemispheres to innervate the clypeus and the labrum; and (3) the cura cerebri arising from the cephalo-ventral border of the hemispheres, and extending downward around the oesophagus to join the sub-oesophageal ganglion on the ventral side. The sub-oesophageal commissure arises from one of the cura cerebri, and extends around the oesophagus to join the other crus-cerebrum on the other side.

In the pupa, each hemisphere begins to extend laterad to form the optic lobe, which becomes fully developed in the adult, joining the brain with the compound eyes on the sides of the head.

2. *The Suboesophageal Ganglion.*

The suboesophageal gaglion is situated below the oesophagus in the head near the posterior margin. It also consists of two hemispheres and from the cephalal border of each hemisphere, three nerves arise together and extend forward. These are the mandibular nerve, the maxillary nerve and the labial nerve which innervate the respective organs. In the adult the bases of these three nerves become separated from each other. Posteriorly the sub-oesophageal ganglion sends out two longitudinal connectives that go backward to join the first thoracic ganglion.

3. *The Thoracic Ganglia.*

There are three thoracic ganglia, each being composed of two hemispheres and situated in each segment below the alimentary canal and above the large ventral muscles. They are connected with each other by the paired ventral connectives. The nerve arrangment of the ganglia may be illustrated by a description of the metathoracic ganglion of the adult as follows.

The metathoracic ganglion is large, and dorsoventrally compressed. It is connected with the mesothoracic ganglion in front and the first abdominal ganglion behind by the paried ventral connectives. From its cephalo-lateral borders a pair of nerves extends cephalo-laterad and a little dorsad to innervate the wings. These are the alar nerves. From its caudo-lateral border another pair of nerves extends caudo-laterad and a little ventrad to innervate the legs. These are called the crural nerves. Between the alar and the crural nerves on each side three nerves extend to the coxal region and they are the anterior coxal, inferior coxal, and posterior coxal nerves. Immediately behind the crural nerve, there is another nerve that goes into the coxa and this is the trochanter extensor nerve.

In the prothorax of the adult there are no alar nerves and the posterior coxal nerve has not been located. In the mesothorax, there is only one nerve between the alar and crural nerves and the trochanter extensor nerve has not been found.

4. *The Abdominal Ganglia.*

In the larva there are eight distinct abdominal ganglia which are connected with each other by the short paired ventral connectives. The first 7 ganglia send out each a pair of nerves to innervate their respective segments. The eighth ganglion is the smallest one and it sends out 3 pairs of nerves to the last three (8th, 9th, and 10th) abdominal segments.

In the pupa and adult the first abdominal ganglion innervates the first abdominal segment while the remaining 7 ganglia become cephalized and fused into one compound ganglion, to lie in the second abdominal segment. This ganglion sends out 7 pairs of nerves to innervate the abdominal segments 2-8.

D. Reproductive System

(Figures 37 to 38)

The sexes are separate and can be distinguished externally in the adults by the color of the labrum, that of the male being white while that of the female is black. Internally the male reproductive system consists of a pair of testes on the sides of the mesenteron in the abdomen, a pair of vasa deferentia that unite in the fourth segment to form the ejaculatory duct and a penis which is enclosed in a sheath, provided with a pair of claspers and withdrawn into the body. The female system consists of a pair of ovaries in the abdomen, and a pair of oviducts uniting in the sixth segment to form the vagina which is provided with a large bursa copulatrix.

1. The Male Reproductive Organs.

The testes are white and thread-like tubes, coiling back and forth into two bundles on the sides of the alimentary canal in the first four abdominal segments. From one end of each testis a vas-deferens extends backward from the second to the fourth abdominal segment to unite on the meson with the other one from the other side so as to form the ejaculatory duct. This duct extends forward to the second abdominal segment, and then bends backward to continue into the chitinized penis which continues backward to the male genital opening, and is enclosed half of its length by a tubular sheath. The sheath terminates posteriorly with a long and up-curved spine above the penis and a pair of claspers which are provided with rows of long hairs at tip.

At the time of copulation, the penis with its spine and claspers are protruded out of the genital opening and are directed downward and forward.

2. The Female Reproductive Organs.

In the abdomen the two ovaries occupy a similar position as that of the testes Each ovary is a compact and spindle–shape organ, composed of a large number of ovarian tubes, each of which contains eggs in different stages of development. All the ovarian tubes in each ovary unite posteriorly to form an oviduct, which soon dilates into an egg calyx. In the sixth abdominal segment, the two oviducts unite to form the vagina that extends backward to the female genital opening below the alimentary canal. A large bursa copulatrix lies above the vagina and opens into it near its posterior end.

III. ETHOLOGY

In working out the life history of *Coelophora swinhoii* Crotch, it was found that the species breeds abundantly in nature in the South Garden about half mile from the University. This facilitated the writer to visit the breeding ground frequently and make observations from their natural habitat. A large number of the beetles has also been bred in the laboratory for study of their life histories. In the following pages there are given the results of the experiment which covers a period of eighteen months from May 1924 through November 1925.

A. Economic Importance

As we are all aware of the fact that aphis or plant lice attack a great variety of plants and cause damages beyond the comprehension of our imagination, we can not but consider the lady-bird beetles one of the most beneficial insects that we have, as their food consists almost exclusively of all species of aphis. Although the problem of economic relationship of the beetles to the aphis is not within the scope of this paper, yet the fact must not be neglected that any artificial propagation of the beetles will help tremendously in checking the aphis in nature.

B. Locality

As mentioned above, South Garden has been the most favorable place for observation and studies of the natural habitat of the beetles. The writer has also had opportunities to collect and record facts about the beetles in several other gardens and some hills in and about the city.

C. Breeding the Adults and Larvae

For breeding purposes in the laboratory, pairs of adults or lots of larvae from the same parents were each kept in a cylindrical glass jar, 6 inches in height and 2 inches in diameter, stopped up by a single layer of cheesecloth with a rubber band. In feeding, plant leaves with any kind of aphis were placed in the jars and were renewed every day. The moisture evaporated from the leaves usually accumulated on the sides of the jars so that the beetles or their larvae often got stuck and died. To prevent this, the jars were each cleaned every day at time of feeding. When a mass of eggs was laid, the adults were immediately transferred to another jar so that each mass of eggs could be studied separately. Each pair of adults together with their offspring were labelled with a linear series of arbitrary numbers.

D. Life History

The adults have been found to hibernate during the winter under the bark of the Elm. After recording the actual date of the first appearance of the adults in the latter part of April, breeding experiments began in the laboratory. The results of such experiments were compared and checked with the observations in nature. In the following paragraphs are given the characters of the different metamorphic stages of the species, the changes that take place during metamorphosis, the length of period covered by each of these stages, and the behavior of the beetle at different stages.

1. *The Egg (Figures 39, 47 and 53).*

The eggs are somewhat oval in shape, measuring 1.37 mm. in length and .63 mm. in width. They are light yellow in color when first laid, but as development goes on they gradually change first into an orange-yellow color and then turn gray at about the time of hatching. They are laid in irregular masses usually attached by one end to the under surfaces of the leaves on which the aphis are found. The total number of eggs laid by each female is directly proportional to the amount of food supply, varying from 345 to 1010. In nature the eggs are often destroyed by ants and sometimes by the hatched larvae when food is scarce. The number of egg masses laid by each female and the number of eggs per mass show quite a great deal of variation. The former ranges from 38 to 116 while the latter, from 1 to 48. The length of the egg stage ranges from 1 to 7 days and averages about four and one half days.

2. *The Larvae.*

In hatching, the larva forces its way out of the egg with its thorax, and it takes about one and one half hours for one to complete the emergence. The body of the larva is long, somewhat dorso-ventrally compressed and tapering at both ends. The thorax is composed of three segments the tergites of which are rugose. The abdomen consists of ten segments, and the last one is provided with a brownish-yellow anal gland and disc which exudes a sticky secretion. All the thoracic and abdominal segments are pubescent. On the dorsal surface of each abdominal segment there are two bristled protuberances near the center and one spine on each of the lateral margins. On each side of an abdominal segment there is also one bristled protuberance that extends laterad. The thoracic and abdominal segments are provided with different color patches which vary in the different instars. There are three molts and four instars in the development of the larva. Before molting the larva attaches itself to the leaves or other objects by the anal disc. Its anterior end gradually bends under the abdomen and the skin begins to split longitudinally along the median line of the meso-and meta-thoracic tergites. It takes about two hours for each larva to complete an act of molting. Immediately after emergence the larva of the next instar is light yellow in color, but in the course of 4 to 5 hours chitinization of the integument and change of color become completed. The larva begins to feed after fourteen to sixteen hours.

(a) THE FIRST INSTAR *(Figures 40 and 48).* The body is black all over with five yellow patches, one on the mesonotum, one on the metanotum, 2 on the lateral margins of the first abdominal tergite and one on the fourth abdominal tergite. When full grown, the body of the larva measures 2.97 mm. in length and .34 mm. in width. This instar lasts from one to five days.

(b) The Second Instar *(Figures 41 and 49).* The general coloration of the body together with the color patches mentioned above becomes darker. A yellow protuberance begins to appear on each side between the metathorax and the first abdominal segment, being visible from above. The terminal segment of the abdomen becomes elongated and the body of the larva measures 3.17 mm. in length by .74 mm. in width. This instar lasts from 1 to 4 days.

(c) The Third Instar *(Figures 42 and 50).* The head and antennae become more prominent and the color patches change into orange-yellow. Two unpaired color patches appear one on the anterior margin of the mesonotum and another on the posterior margin of the first abdominal tergite. Three other pairs of color patches are added to the sides of the 1st, 4th and 5th abdominal segments. The larva now measures 5.5 mm. in length and 1.7 mm. in width. This instar lasts from 1 to 3 days.

(d) The Fourth Instar *(Figures 43 and 51).* The two unpaired color patches on the mesonotum fuse into one and that on the 7th abdominal tergite disappears. All the patches become reddish brown in color. This is the last and also the longest instar, lasting from 3 to 8 days and usually 4 to 5 days. Sometimes on account of unfavorable conditions this instar may be prolonged to a week or more. This mature larva is 9.7 mm. in length by 2.54 mm. in width.

3. *The Pupa (Figures 44 and 52).*

When the larva is ready to pupate it attaches itself to some object by its posterior end and the anterior part of its body bends under the abdomen. After about one day, the larval skin splits and the pupa emerges as a whitish object with pale yellow wing pads and light-brown spots on its dorsal surface. Half an hour later its color becomes darker and darker until after about two hours the chitinization of the integument and the change of coloration become completed. The body is now brown in color with black spots.

The length of the pupal stage varies from two to seven days as governed by climatic conditions. During this stage all its external activities cease, but an internal reorganization goes on until the time of transformation. The body of the pupa measures 6.3 mm. in length by 1.9 mm. in width.

4. *The Adult.*

(a) Transformation. The adult emerges by forcing its way out through the split on the dorso-median line of the pupal skin. It takes about six minutes for an adult to complete its emergence.

(b) Shape and Color. The body is now soft and orange-yellow in color, with two brown dots on the elytra. About four hours later the body becomes more compact and hardened, the elytra change into black color and the two dots on the elytra change into red. It now assumes the hemispherical shape and the normal coloration.

(c) Activity and Feeding. The adults are not very active until about two days after transformation when they begin to crawl about and feed. The number of aphis consumed by each adult every day makes an average of 60 to 70.

(d) Sexual Characters. The male is 6.35 mm. in length by 4.88 mm. in width while the female is 7.19 mm. in length by 5.5 mm. in width. The male can also be distinguished by the fact that its labrum is white while that of the female is black.

(e) Mating *(Figures 45 to 46)*. The adults become sexually matured in 8 to 11 days and at time of mating the male lights on the back of the female with his external reproductive organs extended. By repeated trials he suddenly succeeds in introducing the penis into the vagina between the vaginal plates with the claspers holding the ventral surfaces of the plates. Mating has been observed to last from 4:25 to 6:28 hours and as far as observation goes adults may mate from 18 to 21 times during their life. The adults that hibernate over the winter will mate again after their reappearance in the following spring.

(f) Method For Studying Mating. When adults were found to be mating they were allowed to crawl on a piece of paper and killed instantaneously by quickly plunging the paper into boiling water. They were then carried through a series of alcohols from 10% to 95% in which they were preserved for further studies.

(g) Ovipostion. Oviposition takes place about a week after mating. While ovipositing, the female settles down and feels with her ovipositor from side to side in order to find rough surfaces where the eggs may be laid. The eggs are attached by a gluey substance on the object on which they are deposited.

(h) Length Of The Adult Life. As there are so many factors that affect the life of the adults, the length of the adult stage shows quite a wide range of variation. Disregarding the hibernating adults the males have been observed to live from 54 to 81 days while the females lived from 42 to 126 days.

IV. TAXONOMY

A. List of Species

The following species of lady-bird beetles have been collected in Soochow and vicinity and have been identified by Mr. H. S. Barber of the Bureau of Entomology, U. S. Department of Agriculture.

Order COLEOPTERA
  Suborder COLEOPTERA GENUINA
    Series CLAVICORNIA
      Subseries TRIMERA CLAVICORNIA
        Family COCCINELLIDAE

1. *Adalia bipunctata* (Linn.)
2. *Chilocorus renipustulatus* Scriba.
3. *Chilocorus tristis* Fald.
4. *Coccinella septempunctata* Linn.
5. *Coelophora swinhoii* Crotch.
6. *Epilachna admirabilis* Cr.
7. *Epilachna vigintioctopuctata* (Fabr.)
8. *Epilachna sp.*
9. *Epilachna sp.*
10. *Hippodamia tredecimpunctata* Linn.
11. *Platynaspis sp.*
12. *Propylea conglobata* L.
13. *Ptychanatis axyridis* Pall.
14. *Thea cincta* Fabr.
15. *Thea 12-guttata* Poda.

B. Notes on the Specific Characters

A comparative study of the different species and their forms reveals that there is an infinite variation in size and color among them. There is variation between the sexes in the species and even among the individuals of the same form in a species. There remains a great deal to be done by students in genetics to study the inheritance and variation of the color characters in these beetles. The taxonomic characters of the local species and their forms are given in the following paragraphs.

1. *Adalia.*

Middle coxae widely separated; legs short; head deeply inserted; epipleura wide, concave, not entire; body oval, glabrous above; antennae slightly longer than head; tarsal claw with basal tooth.

A. bipunctata (Linn.)

Head with two yellow frontal marks; thorax with an M-shaped black mark on disk, the broad pale margins without a spot; elytra reddish with a round black spot near center of each; beneath black, tarsi and sides of abdomen reddish-brown; thorax finely and indistinctly punctate; elytra more coarsely punctate with its margins slightly reflexed; length 5-5.5 mm. *(Figure 54).*

2. *Chilocorus.*

Middle coxae widely separated; legs short; head deeply inserted; epipleura very wide, concave, strongly descending on the outer side; body rounded, very convex, glabrous above; frontal plate broadly dilated, concealing the base of antennae and subdividing the eyes; antennae very short, compact, narrowly clavate; thorax very small, deeply emarginate in front and rounded behind; tarsi beneath densely spongy pubescent; front tibia with a small tooth on outer margin near base; thorax pubescent toward sides.

C. renipustulatus Scriba.

Head and thorax black; margins of elytra not reflexed; elytra red with one small rounded reddish-brown spot at center of each; ventral side of thorax and legs black; tarsi with basal tooth; abdomen brown; length 3.5 mm. *(Figure 55).*

3. *Chilocorus tristis* Fald.

Head black or pale red; thorax black; margins of elytra not reflected; elytra together forming a large rounded dark red spot at center surrounded by the black margins; ventral side brown, legs black or brown; tarsi with basal teeth; length 4.5-6.5 mm. *(Figure 56).*

4. *Coccinella.*

Middle coxae widely separated; legs short; head deeply inserted; epipleura wide, concave, not entire; body oval, convex, glabrous above; antennae only slightly longer than head; elytra reddish, tarsal claws with a large subquadrate tooth at base.

C. septempunctata Linn.

Head black with two rounded pale spots on lateral margins; thorax black with large pale subquadrate spot at each apical angle; margins of elytra slightly reflexed; elytra red, with seven black spots; ventral side and legs black; length 6-8 mm. *(Figure 57).*

5. *Coelophora swinhoii* Crotch.

Middle coxae widely separated; legs short; head deeply inserted; epipleura wide, concave and complete, body rounded, convex, glabrous above; antennae long, thorax black at middle with two large oval white spots on sides; head black; margin of elytra not reflected; black beneath, with sides of abdomen red; legs black, tarsal claw with basal tooth; elytra black with a small rounded red spot at center of each; length, male 5-6.5 mm., female 7 mm. *(Figure 58).*

6. *Epilachna.*

Middle coxae widely separated; legs short; head deeply inserted; epipleura wide, horizontal or slightly concave; body pubescent above; antennae long; thorax deeply emarginate at apex; margin of elytra strongly reflected; tarsal claws cleft, the lower cusp nearly as long as the upper one.

E. admirabilis Cr.

Head brown; thorax black with brown border; body black beneath; legs brown or with femora in black; abdomen brownish-black; epipleura horizontal; elytra brown, with ten very large black spots, two sutural and four on each side; length 6.5 mm. *(Figure 59).*

7. *Epilachna vigintioctopuctata* (Fabr.)

Head brown; thorax brown with six black spots; metasternum black; abdomen brownish black or brown, legs brown; elytra brown with twenty-eight black spots; length 5.5-6 mm. *(Figure 60).*

8. *Epilachna sp.*

Head brown; thorax brown with two black spots; body brown beneath; legs brown; elytra brown with eight to ten black spots; length 5-6 mm. *(Figure 61).*

9. *Epilachna sp.*

Head brown; thorax black with brown margin; metasternum black; abdomen brownish black; legs brown; elytra brown, with eleven large black spots, one sutural and five on each side; length 6 mm. *(Figure 62).*

10. *Hippodamia.*

Middle coxae narrowly separated; body elongate-oval, glabrous; legs long, free; head not deeply inserted; thorax strongly sinuate but not covering the eyes, not margined at base; antennae very short; tarsal claws bifid, the two lobes unequal in length and acutely pointed; hind tibial spurs distinct.

H. tredecimpunctata Linn.

Head black, its anterior margin pale, thorax with large square black area and black dots; margins of elytra slightly reflexed; elytra with thirteen black spots; ventral side of thorax and abdomen black; femora black, tibiae and tarsi pale; length 6.5 mm. *(Figure 63).*

11. Platynaspis sp.

Head black with brownish anterior border; thorax black with narrow white lateral margins; elytra reddish yellow, forming together a broad longitudinal black bar along the suture with two very large subspherical black spots on each elytron; the smallest local species; length 2.5-3 mm. *(Figure 64).*

12. Propylea conglobata L.

Middle coxae widely separated; legs short; head deeply inserted; epipleura wide, concave, not entire; margins of elytra slightly reflexed; body oblong oval, glabrous above; antennae long; tarsal claw with basal tooth; prosternal spine narrow; body yellow to brownish-yellow above, black beneath; legs yellow; meso-epimeron white; eleven forms of the species, each differing from the other in shape, size, number and distribution of black spots on head, thorax and elytra; length 3.5-4.5 mm. *(Figures 65 and 69).*

13. Ptychantis axyridis Pall.

Middle coxae widely separated; legs short; head deeply inserted; epipleura wide, concave, not entire; margins of elytra slightly reflexed; body round to oval, glabrous above; antennae long, truncate at tip; tarsal claw with basal tooth; ventral side of body and legs black, blackish-yellow or yellow; meso-epimeron white. Eighteen forms of the species, each differing from the other in shape, size, number and distribution of color spots on head, thorax and elytra; elytra either black with red spots or reddish with black spots, these two distinct types being linked up by an intermediate form; in the black elytra series a gradual increase of red areas while in the red elytra series a gradual reduction of black areas; the extremes of all the forms being black with two red spots on one hand and red without spots on the other. Length 6-7.5 mm. *(Figures 66 and 70).*

14. Thea.

Middle coxae widely separated; legs short; head deeply inserted; epipleura wide, concave, entire; antennae slightly longer than head; tarsal claw with basal tooth.

T. cincta Fabr.

Head yellow; thorax yellow with rounded black dots on posterior margin; elytra, legs and ventral side of body yellow all over; body glabrous above and beneath; tibiae and tarsi pubescent; length 5 mm. *(Figure 67).*

15. Thea 12-guttata Poda.

Head brown; thorax brown with two to four white spots with or without two black spots; body brownish-yellow beneath; elytra brown with twelve rounded white spots; length 4-5.5 mm. *(Figure 68).*

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A.	acl	anteclypeus
	acn	anterior coxal nerve
	aepm	anepimeron
	aeps	anepisternum
	aln	alar nerve
	anp	anterior notal process
	ant	antenna
	antn	antennal nerve
	ants	antennal sclerite
	aos	adanal ossicle
	atcxp	antecoxal piece
	axin	axillary incision
B.	bc	bursa copulatrix
	bm	basement membrane
C.	c	costa
	car	cardo
	cc	crus cerebri
	clas	claspers
	clln	clypeo-labral nerve
	cm	circular muscle
	col	colon
	cond	condyle
	crn	crural nerve
	cs	coronal nerve
	cu	cubitus
	cxc	coxal cavity
D.	dig	digitus
E.	e	compound eye
	ec	egg calyx
	eccm	ectal circular muscle
	eclm	ectal longitudinal muscle
	ejd	ejaculatory duct
	ely	elytra
	enlm	ental longitudinal muscle

	ep	epithelium
	epc	epicranium
	epcs	epicranial suture
	ephy	epipharynx
F.	fr	front
G.	ga	galea
	gu	gular
H.	h	humal cross vein
I.	icn	inferior coxal nerve
	il	ileum
	in	intima
J.	js	jugular sclerite
K.	kepm	katepimerum
	keps	katepisterum
L.	lac	lacinia
	li	labium
	lig	ligula
	lin	labial nerve
	lm	longitudinal muscle
	lp	labial palpus
	lr	labrum
M.	m	media
	md	mandible
	mdn	mandibular nerve
	mds	mandibular sclerite
	men	mentum
	mes	mesenteron
	mos	median ossicle
	mpt	malpighian tubule
	mr	median recurrent
	mx	maxilla
	mxn	maxillary nerve
	mxp	maxillary palpus
N.	nos	notopleural ossicle
	np	notal process
O.	od	oviduct
	oe	oesophagus
	ot	ovarian tube
P.	p	penis
	palb	prealar bridge
	pcl	postclypeus
	pcn	posterior coxal nerve
	pm	peritrophic membrane
	pnp	posterior notal process
	ppl	propleurum
	prnt	pronotum
	ps	penial sheath
	pscl	post-scutellum
	psct	prescutum
	ptl	posterior lobe
R.	r	radius
	rect	rectum
S.	sbap	sub anal palate
	sbgl	subgalea
	sbmen	submentum
	sboec	suboesophageal commisure
	sboeg	suboesophageal ganglion
	sc	subcosta
	scl	scutellum
	sct	scutum
	spap	supra anal plate
	spoeg	supra-oesophageal ganglion
	stn	sternum
	stp	stipes
T.	terg	tergite
	texn	trochanter extensor nerve
	thg	thoracic ganglion
	tn	trochantin
	tt	testicular tube
V.	vag	vagina
	vc	ventral connective
	vd	vas deferens
	vv	vaginal valve

EXPLANATION OF FIGURES

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Fig. 6. Maxilla of the adult.
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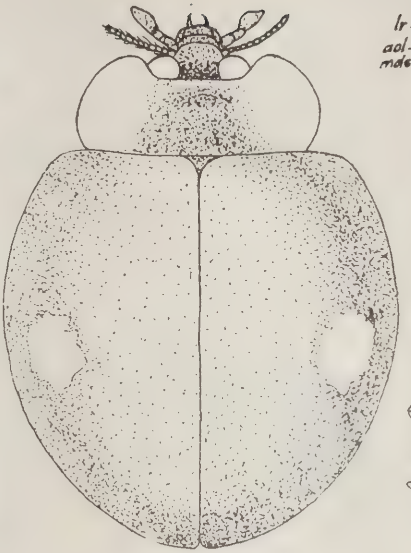
A. Diagrams of the series, showing black elytra with increasing red areas.

B. Diagrams of the series, showing red elytra with decreasing number of black spots.



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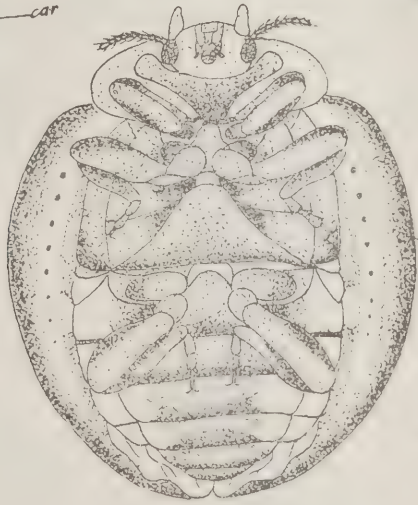

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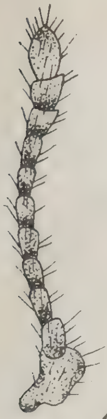

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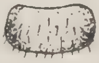

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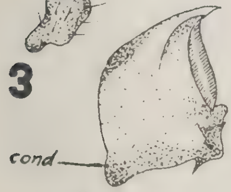

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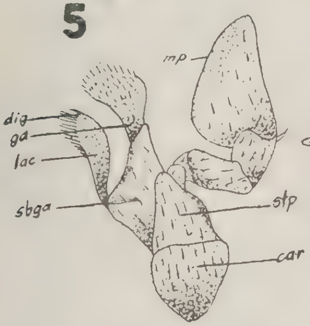

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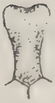

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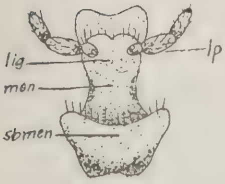

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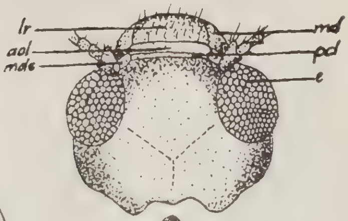

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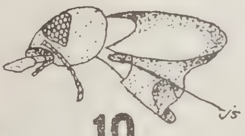

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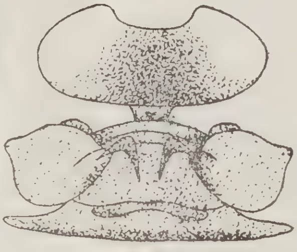

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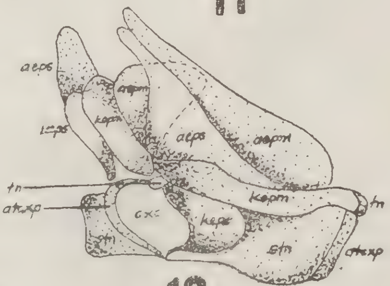

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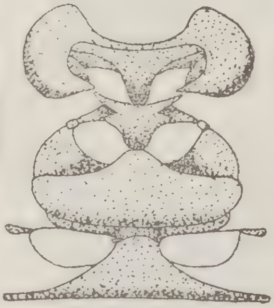

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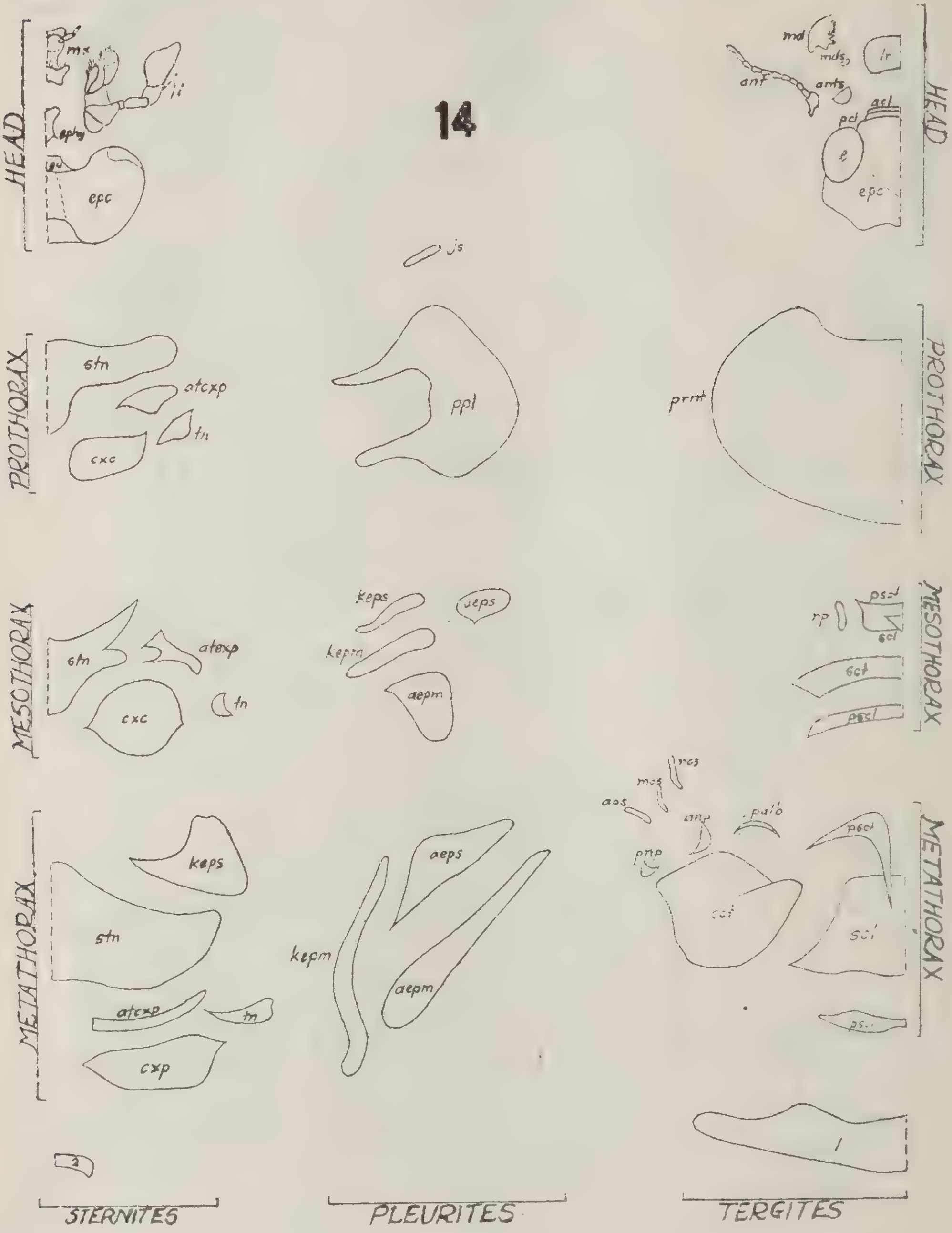
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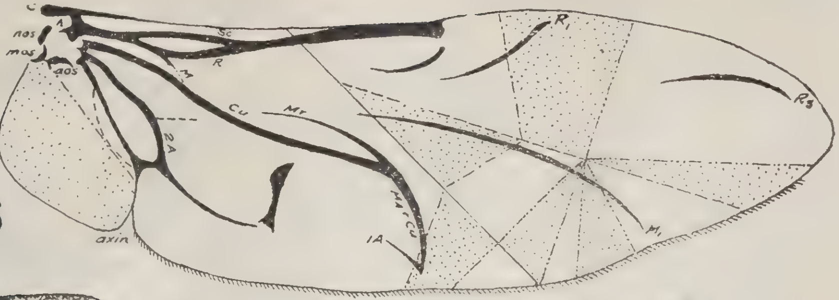

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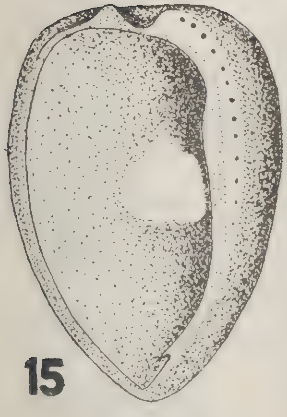

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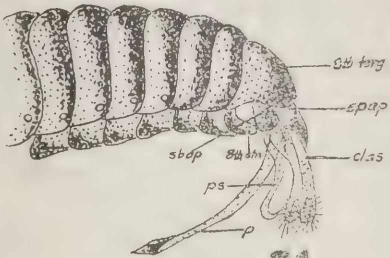

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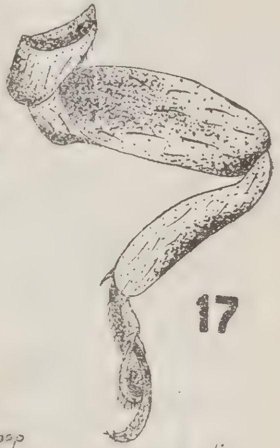

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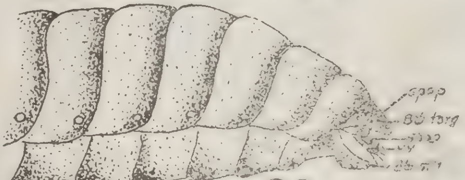

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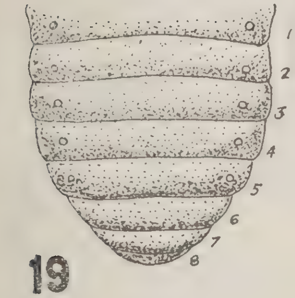

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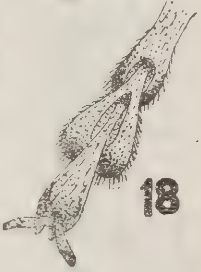

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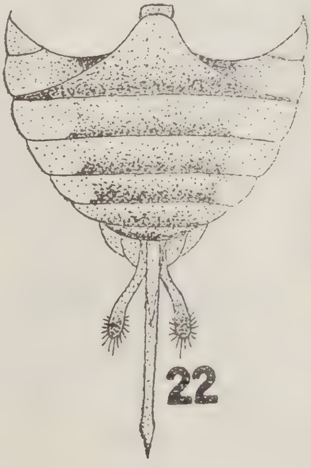

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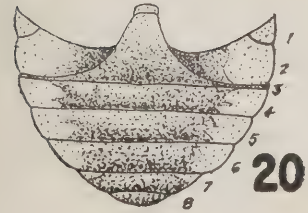

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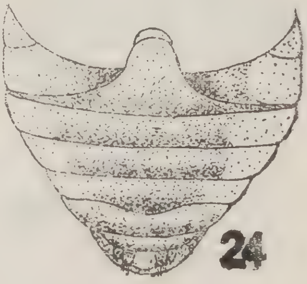

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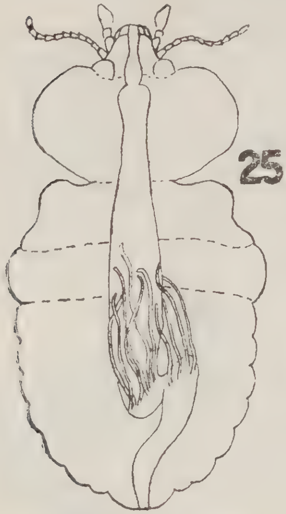

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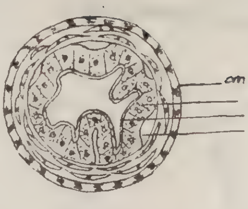

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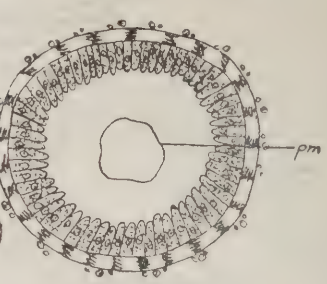

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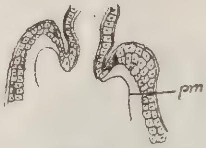

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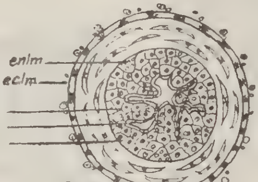

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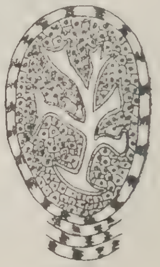

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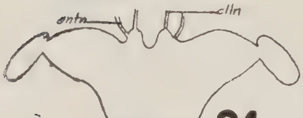

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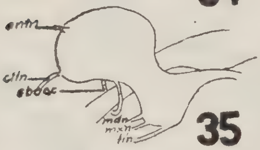

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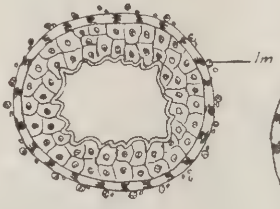

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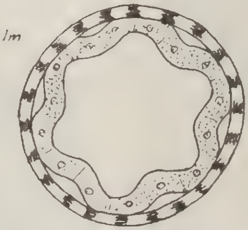

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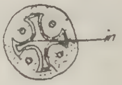

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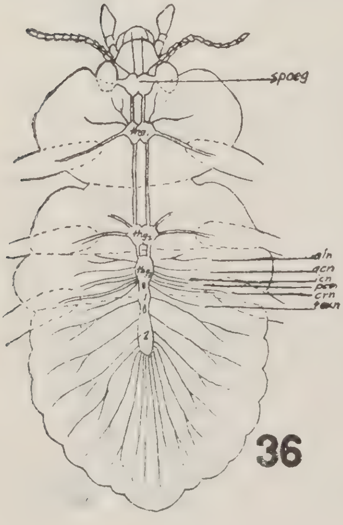

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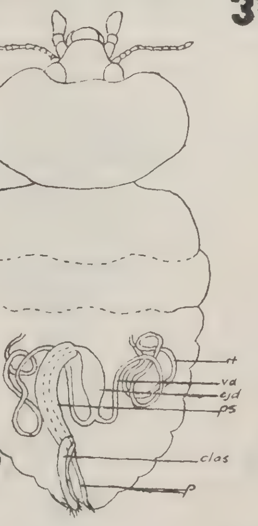

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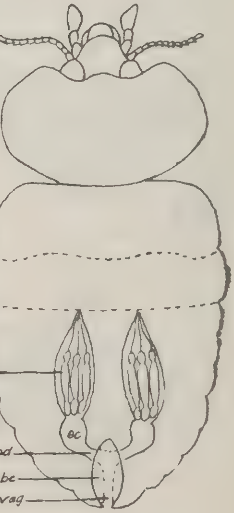

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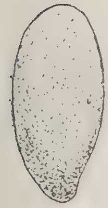
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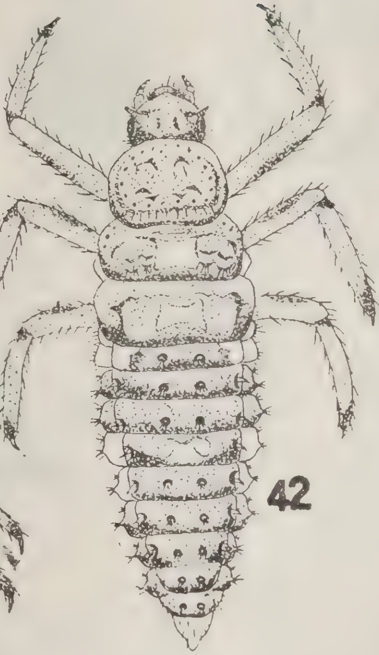
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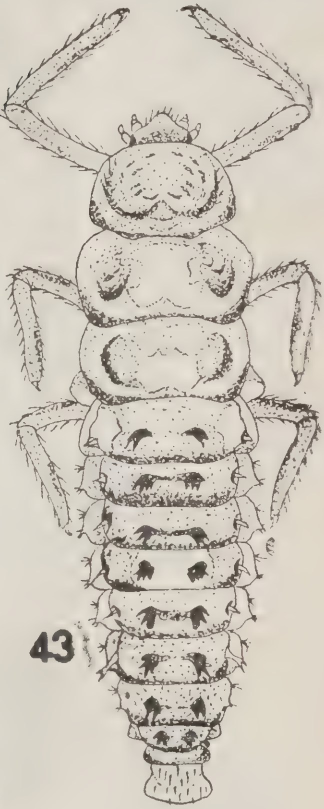
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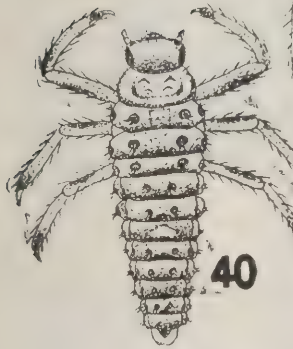
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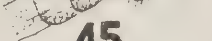
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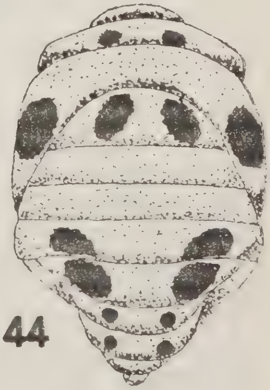
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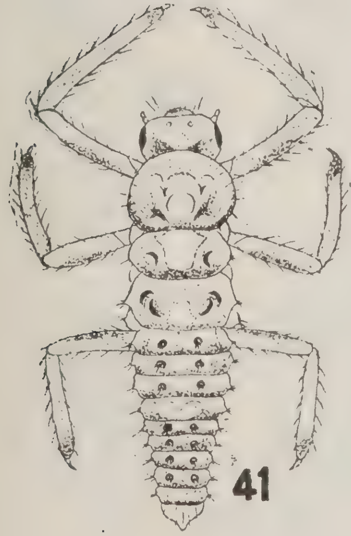
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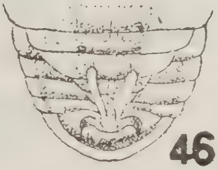
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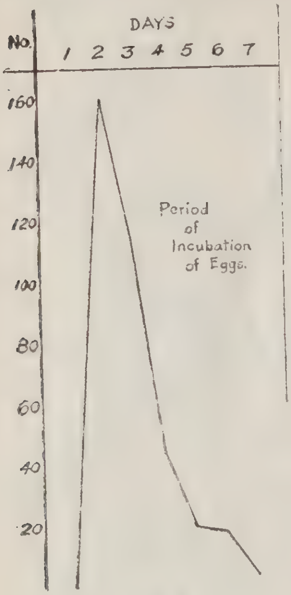

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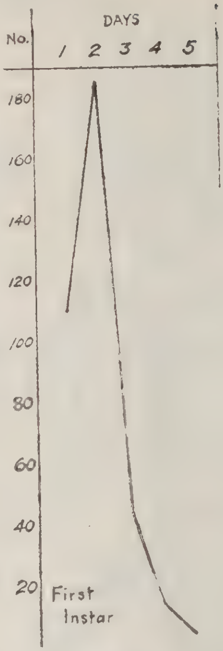

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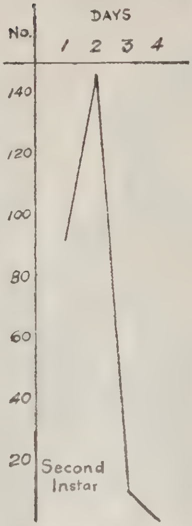

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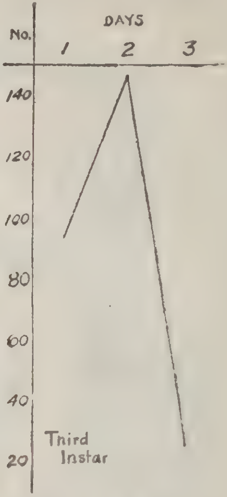

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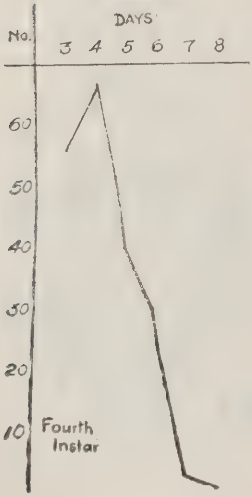

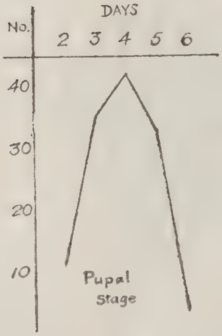

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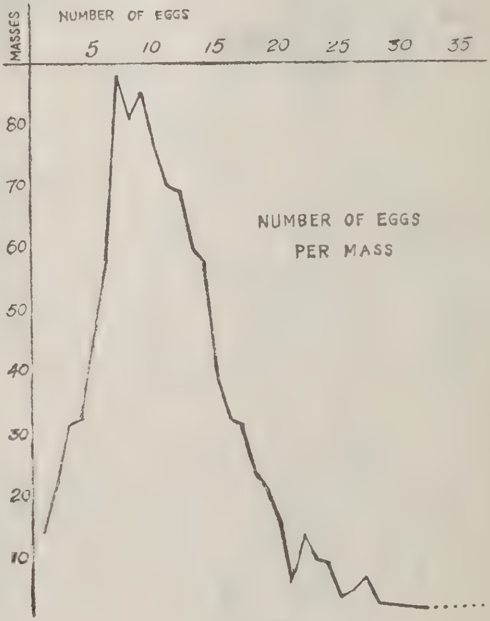

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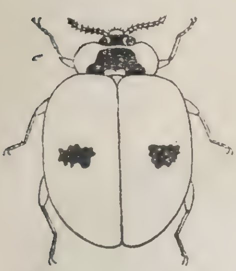
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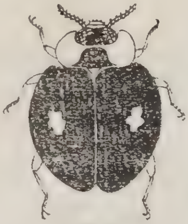
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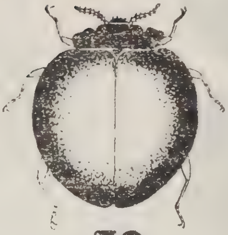
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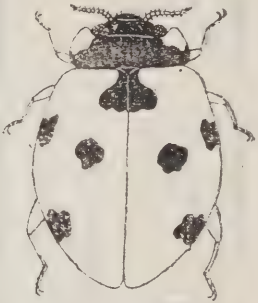
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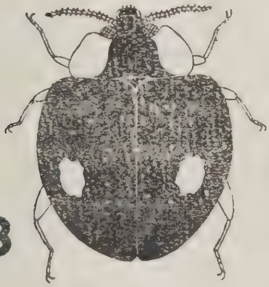
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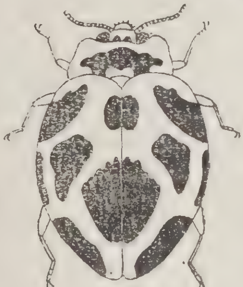
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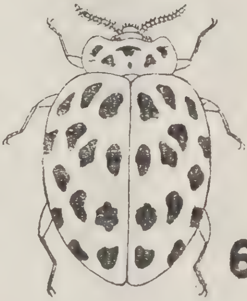
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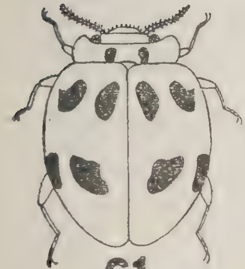
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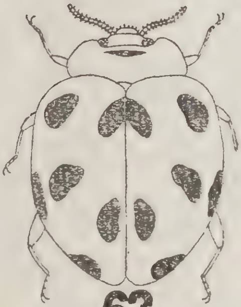
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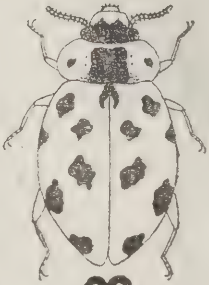
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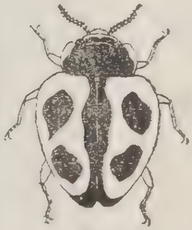
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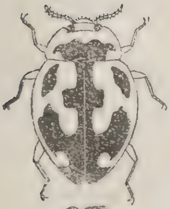
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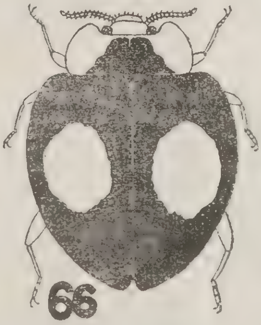
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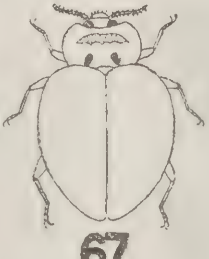
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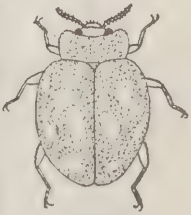
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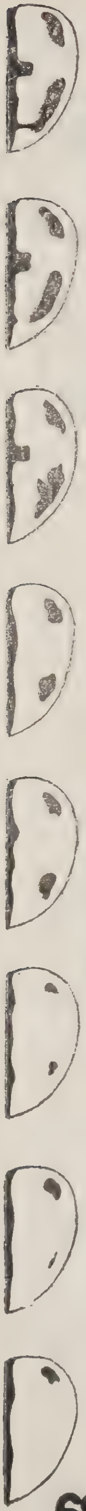

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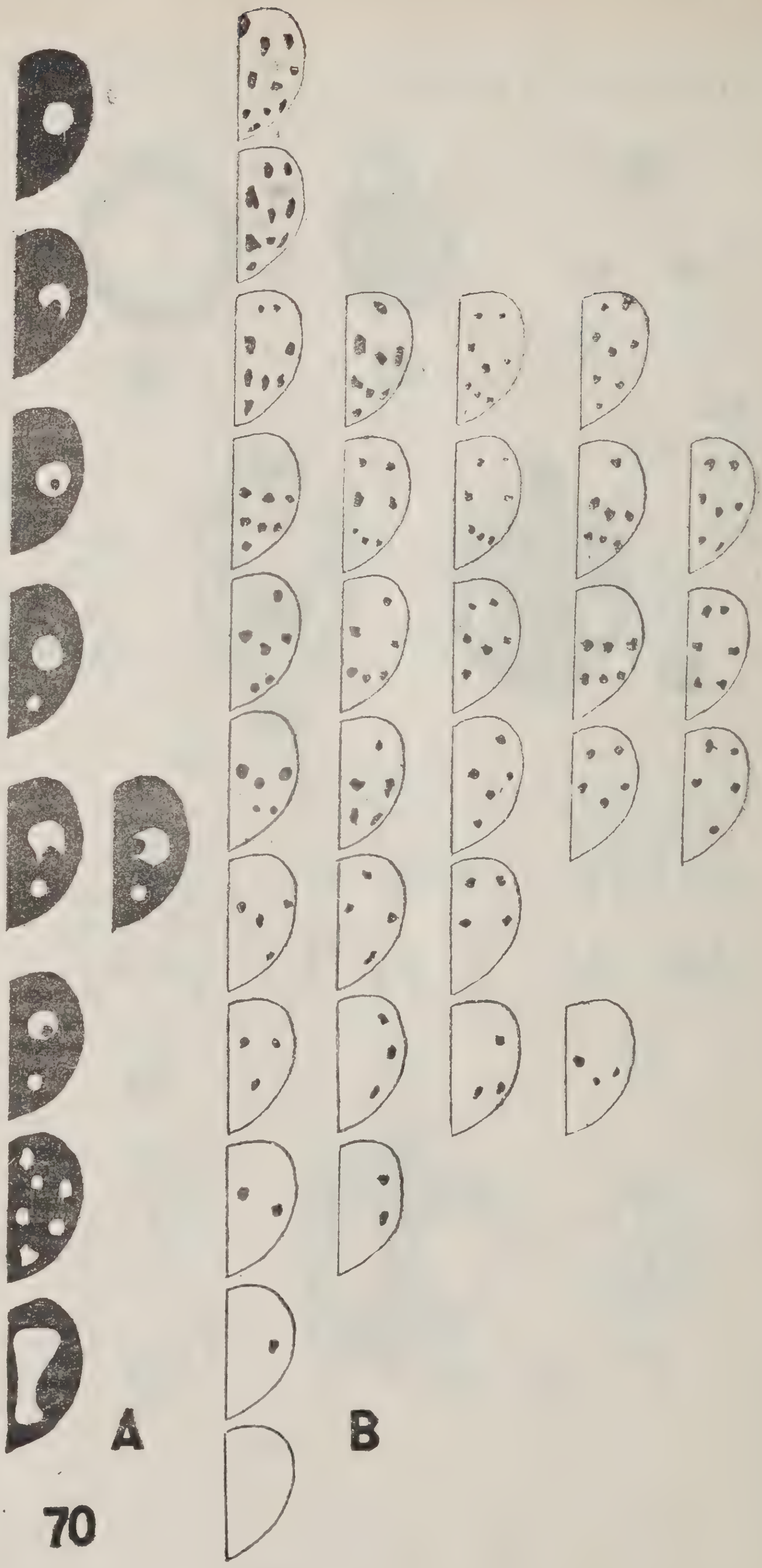

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NOTES ON LITCHEE INSECTS

By David T. Fullaway

Entomologist, Board of Agriculture & Forestry, Honolulu, Hawaii.

The litchee *(Nephelium litchee)* is extensively grown in the vicinity of Hong Kong and Canton and its fruits are most delicious. The crop, however, is often very light, although the trees may blossom profusely. Unfavorable weather conditions is usually the ascribed reason, but on one occasion when I was present in Hong Kong in the blossom season my attention was called to the work of a lepidopterous borer attacking the fruit and by close investigation I was able to satisfy myself that the scarcity of fruit that year (1925) was due almost entirely to the attacks of this insect. The fruit is entered when quite small and much of it falls to the ground in an immature condition. By collecting larger infested fruits I was able to rear the worm, which I recognized as a lycaenid larva. Consulting Kershaw's list of Lepidoptera collected in that region I was unable to find any reference to a Lycaenid attacking litchee amongst those species whose food habits had been observed. On returning to Honolulu, however, I was able to have the few butterflies I was fortunate enough to rear determined by Mr. O. H. Swezey of the Hawaiian Sugar Planters' Experiment Station. Mr. Swezey identified the species from Kershaw's illustrations as *Deudorix epijarbas* Moore. The male is unlike the female, having considerable red in the wings on upper surface whereas the female is dull fuscous brown with olivaceous and metallic tints. The under surface is very much lighter in color with rather indistinct transverse bands. There are darker maculations towards the tail as usual in this group. The larva as I recollect is light yellowish brown, depressed, with rounded anterior and posterior ends and with tense and highly sensitive skin covered with longer lighter and shorter darker hairs. It generally leaves the fruit to pupate and the chrysalis is attached by a slender thread to the surface on which it rests. This form is 17 mm. long, 1 or 2 mm. shorter than the larva, somewhat larger at one end, carneous to brownish colored and more or less smooth. This species is also believed to occur in the Philippine Islands (ex-F. X. Williams Coll.) The larva there infests a wild species of *Nephelium.*

There is also present in the Hong Kong region another borer which infests litchee fruits but this worm is quite different from the one just described, being the larva of a tortricid moth, *Argyroploce (Cryptophlebia) illepida* Butl. This species has a wide distribution. It is believed that specimens collected in Australia, India, South Africa, Southern China and Honolulu can all be referred to one species. I have been familiar with this species for many years, as it is common in Hawaii, and presumably was an early immigrant here. It is listed in *Fauna Hawaiiensis*, where color variations are recognized. The larva is a typical tortricid larva, about 15 mm. long, dull whitish with a rosy tinge, head and cervical shield brownish, tubercles large and black. The pupa is medium brown, about 10 mm. long, with transverse rows of spines on the dorsal surface of the abdominal segments. The adult is a reddish fawn color, thorax shaded with greyish fuscous above the same as the tegulae, forewings pale fawn-reddish with indistinct transverse waved greyish fuscous striae and a few dots of blackish scales, a minute dot of white scales at the end of the cell, the dorsum near the base also sprinkled with blackish scales; before the tornus is a ferruginous triangular patch sprinkled with blackish scales which run through the tornal cilia; cilia reddish fawn somewhat mottled with greyish fuscous. Expanse 18-22 mm. Hind wings greyish fuscous, male with dark fuscous scales in the fold; cilia of the male whitish, of the female brownish grey with a dark line running through them near their base; underside strongly mottled. Abdomen greyish fuscous, anal tuft pale cinerous. Legs pale cinerous. In Hawaii, in addition to attacking the litchee crop, the larvae infest the pods of *Acacia koa* and *Acacia farnesiana* feeding on the growing seeds; also the Macadamia nut.

At the same time these lepidopterous pests of the litchee are noted, it is desired to mention briefly some other pests of the litchee common in Hawaii, viz.:

Eriophyes sp. a mite, causing leaf injury similar to erinose. Very severe at times.

Aulacaspis major and *Fiorinia nephelii*, diaspine scales attached to the litchee, common but not very troublesome.

A mealy bug (probably *Geococcus radicum*) infesting the roots of layering plants.

Saissetia hemispherica, one of the soft scales, infests weak trees.

Amorbia emigratella, Tortricid, larva a leaf-tying caterpillar, also infests flower stems and causes considerable dropping of the fruit.

SOME NOTES ON CHINESE FRESH-WATER SPONGES.

By N. Gist Gee

China Medical Board, Peking, China.

We are so accustoned to the association of ideas in our thinking that at the very mention of the word "*sponge*" our minds at once bring up before us visions of the various kinds of bath sponges with which we are already familiar either from having used them or having seen them displayed in the shop windows for sale. In most instances, however, these marine or salt water sponges are quite different from the sponges which we find in our fresh waters here in China. We have found in and around Soochow several specimens of a very common sponge, *Ephydatia fluviatilis* which were large enough in size and similar enough in general structure to bath sponges for even a novice to recognize the resemblance between the two. On the other hand many of the rarer and smaller fresh-water sponges are very small and would not be observed except by the trained naturalist who sees many interesting things which escape the eyes of the average person. The fresh-water sponges may be very thin films coverings rocks, roots of trees, piles or other supports on which they may grow in the water or they may at times be found on water plants or even on the shells of molluscs. Again the larger types may form small masses four or five centimeters or more thick and may be found growing from the stone walls enclosing the artficial ponds which are so abundant in the gardens in the city of Soochow and also in many other cities in that part of the country.

Color

The color of the colony of animals is determined very frequently by the character of the water and the position in which the sponge is growing. If the water is very clean and free from sediment, the sponge may vary from an almost colorless mass to a straw or light brown color; some sponges are grayish in color and others may be almost black. We have found the *Spongilla fragilis*, when dried on the stone walls at Nanking, to be quite black. Frequently solid matter in the water may give a color to the sponge colony which obscures its natural color. One of the most interesting of the color phenomena which we find in sponges is the green color found in some colonies which grow in well lighted positions. The green color is due to the presence of a very simple green algal form, usually *Chlorella*, which is scattered throughout the structure and grows in a symbiotic relationship with the sponge.

Habit of Growth

We have mentioned certain places where sponges may be looked for, but how are we to know them, when we see them? The best advice is to go out collecting with some one who is familiar with these animals and le thim show you how and where to find them! There is no need to look for sponges is water that is heavily laden with sediment of any kind, for this solid matter would soon fill the pores and kill the animals. Sponges prefer reasonably clear water and in Soochow and Tsinan are very common in water that is freely moving. In Soochow in one canal we have taken quite a lot of sponges, *Spongilla* and *Trochospongilla*, growing in thin layers of about a centimeter or two in thickness and covering areas as large as twenty five by forty or fifty centimeters, from the stone bases of bridges where the water was flowing quite swiftly. In similar positions in the stream flowing from the springs in Tsinan we have collected some specimens of *Ephydatia* with projections as much as six or eight centimeters growing from the masses which were often at least thirty or forty centimeters in length and breadth. Again in garden ponds in Soochow we have collected masses of sponges, *Ephydatia*, nicely and symmetrically shaped which measured as much as twelve to fifteen centimeters in diameter and which were at least ten centimeters thick. On the other extreme we have collected very minute colonies of *Spongilla* growing on the leaves of certain water plants, *Vallisneria* and *Ceratophyllum*. when the sponge was only a millimeter or two in thickness and the whole colony not more than one centimeter or two in length and possibly less than this in width, being limited by the width of the leaf of the plant. Between these two extremes there are all degrees of intermediate size and habit of growth.

How to Collect Them

The writer is very desirous of securing as large a collection of sponges as possible from as many localities as they can be obtained in order to make a careful study of this group of animals from all parts of China as well as other parts of the world. He would, therefore, be most appreciative and grateful for specimens, as large in size and as numerous as possible, from any one who happens to be able to collect sponges.

Best Time to Collect Sponges

The most satisfactory time of the year to collect fresh-water sponges in this latitude is in the late fall or winter as at that time the colonies usually have an abundance of gemmules. Also at this season of the year the water in the canals, ponds and streams in central China is lower than usual. This low water leaves many of the sponges, which grow near the surface of the water in the summer, exposed and thoroughly dried out on the stone bunding or the piles along the canal banks. It is well to examine the under surfaces of stones and floating wood also as these are good places for sponges. In collecting these specimens care should be taken to remove even the bottom layer, which is closely attached to the support, for often the gemmules are developed in a very thin layer in this portion of the sponge and the gemmules are very important in the later study of the specimens. The best thing for removing the sponges is a thin, flexible spatula or a wide section-lifter such as is commonly used in biology laboratories. If the sponge is growing on a wooden pile it is often possible to strip the bark from the pole and thus easily get the whole sponge with the bottom layer attached to the bark. Remove the specimens in as large pieces as possible and put on pieces of paper where each specimen should be kept separate from those taken at other places. For each specimen make a note of the place, the kind of support upon which the sponge was attached, the nature of the water, the date of collection and the name of the collector.

Drying and Wrapping

All specimens should be dried in the shade. It is often necessary to turn the larger specimens several times to get them thoroughly dry. Those collected wet have a very disagreeable odor at certain stages of their drying out and should, therefore, be put in an unused place during this time. When the specimens are thoroughly dry, they should be wrapped each piece of sponge separately [so that there will not be a mixture of spicules] in a soft paper in which is put a slip of paper giving the details concerning the occurrence and collection of the specimen. Old Chinese newspapers are soft and make good wrapping paper for these specimens. Never wrap them in cotton as the fibers get caught by the sponge spicules and are very difficult to separate from the sponge later when it is unpacked.

Mailing

The best plan for mailing is to pack the specimens tightly to avoid their shifting back and forth in the box, but not so tight as to crush or disfigure them. The specimens should be put into light wooden boxes, or better still in tin boxes, these covered with corrugated paper securely wrapped and tied and then mailed to the writer at the address given above. Often it is possible, when the packages are large, to arrange for some one in passing to leave the package in Shanghai or some other port city and it can often be called for in person by the writer or some friend who is passing. This being the case we would appreciate a post card from the person who is willing to collect specimens and we can then make detailed plans as to how to handle them.

Preserved In Alcohol

It is desirable that smaller specimens, which are often quite minute, should be dropped, when collected wet, into 95% alcohol (the ordinary spirit of wine) and thus preserved. These small sponges should not be removed from their support unless it happens to be too large an object.

If the sponge is growing on a plant, put that portion of the plant also into the alcohol. When the sponge is a large one and is going to be dried, it is often desirable to have small bits of it with gemmules which are collected wet also placed in alcohol while still wet as this preserves certain cellular characteristics which are helpful in determining the species to which the sponge belongs.

Basis of Classification

Sponges vary so much in general external form under differing conditions that the form is not a reliable basis for determining the species of the sponge. The same species may have quite a different appearance in running and in stagnant water. This being the case, sponges must be classified upon characteristics which are more constant. Students of this group of animals have found that the spicules or little silicious skeletal structures are far more constant than external form and for this reason they have adopted these spicules as the chief basis for grouping the known fresh-water sponges into genera and species.

Skeleton Spicules

There are two common types of spicules in most of the sponges, a third type, the dermal spicules, is sometimes present. The most numerous as well as the most conspicuous type is that of the skeleton spicules. These are usually long and needle-like, and are sharp at both ends as a rule, though a few forms have blunt or rounded ends. These spicules may be smooth or they may be covered with spines which vary in size with the different forms. At times these spicules instead of being straight, as they are in most cases, may be slightly curved. The size of the skeleton spicules varies quite a great deal but to say that most of them lie between 100 and 300 microns (one millimeter equals 1,000 microns) in length will give some idea of how minute they are. They are not clearly visible to the unaided eye and a microscope which magnifies several hundred diameters is required in order to study these spicules with any degree of satisfaction. *(Figs. 1 & 2)*

Dermal Spicules

Sometimes in addition to the skeleton spicules, one will find a smaller and a different kind of spicule scattered through the dermal portion of a sponge. Spicules of this type are not present in all sponges and thus they are frequently a help in the determination of the species of the sponge under consideration. One must not confuse the young, growing skeleton spicules with those dermal spicules. Usually they are different enough to be easily distinguished from those of the skeleton.

Gemmules

The sponge forms a peculiar little reproductive body, called a gemmule, which is one of the means of carrying the animal through the cold winter when the water is frozen and the sponge is killed, or when the sponge is killed by the drying up of the water in which it usually grows. These little gemmules are often present in such large numbers and make up such a large part of the sponge that the boatmen have noticed them and call them prawns' eggs. This is quite a natural error for these untrained men to make as they are accustomed to catching for food the small prawns which are so abundant in the canals in the lower Yangtze Valley and they find that these gemmules are very similar in size and often even the same in color as the eggs of the prawn. The boatmen have overlooked the fact, however, that the female prawn carries its eggs with it and does not lay them in such places as the sponge gemmules are found. These gemmules are large enough to be clearly visible to the unaided eye in most cases and with a hand lens magnifying from eight to ten diameters, we can get a splendid view of them.

Gemmule Spicules

These sponge gemmules are usually thoroughly protected by a covering of minute spicules of silica which prevents them from being easily crushed or destroyed. When water and temperature conditions are again favorable for growth of the sponges the gemmules start new colonies. The gemmule spicules with which we generally meet in the sponges in China are of three district types, one for each of the three common genera of sponges here.

GENUS SPONGILLA

The first are the needle-like gemmule spicules, smaller by a great deal than the skeleton ones, which may be smooth or spined, straight or curved. They vary a great deal in size, shape, and general character and these differences are of assistance to us in determining the species of the genus *Spongilla* to which the sponge being examined belongs. *(Fig. 3)*

GENUS TROCHOSPONGILLA

The second kind are those that resemble in general appearance an ordinary collar button. The spicules of this type have two smooth edged discs or rotulae, connected by a shaft or rod and they are embedded in a micro-cell coat covering the gemmule in a single layer making an attractive and interesting protective device. These discs in some forms vary somewhat in size; usually the larger discs are next to the gemmule while the other smaller ones form the outer layer of the protective coat. These are easily distinguished from all other kinds of gemmule spicules and their size, length of shaft and general shape of disc are partly the bases upon which the various species of *Trochospongilla* are determined. *(Fig. 4)*

GENUS EPHYDATIA

The third kind of gemmule spicules more nearly resemble in general form the metal spool on which the kodak films are rolled than any other object with which we are familiar. Here we have also two discs connected by a shaft which varies a good deal in length, but the edges of both of the discs are not smooth as in the second kind just described but are incised or teethed. The depth of the incisions, the length of the shafts which connect the discs, the smoothness or spininess of the shaft and the position of the spicules in the coat covering the gemmule all enter into the determination of the species of the genus *Ephydatia* to which some sponges belong. *(Fig. 5)*

Preparation of Slides for Examination

In order to determine the species to which a specimen of a fresh-water sponge belongs, it is highly desirable to have at least three prepared microscope slides of materials from the sponge in addition to a good museum specimen of the sponge itself as it was found growing. We will dercribe our procedure in preparing these slides.

Spicule Slide

The first slide is prepared by taking a small piece of the sponge, the size of apea and containing gemmules and other parts of the specimen representing the bottom layer, the intermediate area and the surface portion, and putting these into a small test tube about ten centimeters long and one and one fourth centimeters in diameter. On this we pour concentrated nitric acid enough to cover the material in the tube and boil it violently for a couple of minutes. Be careful to turn the open end of the tube away from your face as the acid sometimes sputters and it burns badly if it gets on the skin. When all of the organic matter in the tube has been destroyed and only the clean silica spicules are left, the tube is then filled with water and shaken up and down to wash the spicules free from any sediment. After allowing plenty of time for all the spicules to settle down to the bottom of the tube, the water is poured off and the tube is again filled with water and shaken to repeat the washing and to get rid of any trace of the acid. We usually wash the spicules in at least three changes of water. When the spicules are clean, we take them up in a small glass tube and transfer some to a clean microscope slide, arrange them as we wish them to be by using dissecting needles and then put the slide aside in a dust proof drawer to dry. Precautions must be taken to keep the test tubes, the glass tubes used in transferring the spicules, the dissecting needles and all the other apparatus used perfectly clean and free from a mixture of spicules from several sponge specimens. If a mixture of spicules is made it becomes very difficult to determine the species of the sponge. After a period of two or three days, the spicules on the slide will have dried sufficiently to be heated over an alcohol lamp to free them from any moisture and then they can be mounted for permanent use by putting on a drop of Canada balsam and covering it with a clean dry cover glass. It is advisable to mount three or four slides from each specimen if you wish to exchange slides with other workers. In order to keep clear track of our slides and avoid confusion in our records, we give each specimen of sponge a serial number as we place it in our collection and this number is kept for all slides from that sponge.

Gemmule Slide

Next it is desired to have a good slide of the gemmules of the specimen under study. Our most satisfactory mothod of securing these is to pick out a number of gemmules, free them form all adhering extraneous materials, and then put them into a 10% Potassium Hydroxide solution and leave them for a week or ten days, or longer if necessary, to get the desired results. The caustic potash destroys most of the organic matter. When the gemmules are ready for use, wash them very thoroughly in a number of changes of water to get them free from the caustic Potash and then put them into about 70% alcohol for a good washing, then they can be put into 95% and 100% alcohol and, after a time, finally transferred to Xylol and left in this until they are thoroughly cleared. Do not allow the gemmules to dry out or they will get air bubbles in them and ruin them for mounting in that condition. When they become clear enough to be seen through under the microscope they are ready to be permanently mounted in balsam, and care should be taken to see that several, but not all, of the gemmules in each slide are crushed by pressure on the cover glass so as to get a good view of the structure of the gemmule covering. Care should be taken to show in this slide the opening or foraminal tubule of the gemmule.

Slide Showing Skeleton Structure

The third slide that is needed is a thin section through the sponge which will show clearly its skeletal structure and also the position and arrangement of gemmules within this skeleton. This section must be cut at such an angle as to show the system of vertical rays composed of skeleton spicules bound together by spongin with the lateral rays connecting the several vertical rays. If the section can be cut through a portion of the sponge bearing gemmules, one is often able to get a section through a gemmule. We use old safety-razor blades to make these sections and we cut them free hand and mount them without any stain. The sections are best made from dry sponges and they should then be placed on the microscope slide and soaked in Xylol to get rid of air bubbles and then mounted permanently in balsam with proper size cover glass to make a neat mount. Be sure to give full data concerning each slide on a label securely pasted on it. It requires a good deal of practice to make a neat mount of these transverse sections of sponges.

China Fresh-Water Sponges

Beside a casual mention of the use of a sponge in China as a medicament by a European writer, A. Tartarinow, in his " Catalogus Medicamentorum sinensium quae Pekini comparanda et determinanda curavit," Petropoli, 1596, and a statement by Lemmermann that he found spicules of a fresh-water sponge in the dredgings from the Yangtse River bottom years ago, we do not know of any very early work along this special line here. The little that we now know of our sponges has been learned within the last fifteen or sixteen years.

The present writer collected some small specimens of sponges from a canal just outside of the eastern gate of the city of Soochow, Kiangsu, in the early years of 1900. A portion of these specimens was sent to the U. S. National Museum, Washington, D.C., and was later sent by the Museum to Dr. N. Annandale, Director of the Zoological Survey of India, at Calcutta, for study and identification. Dr. Annandale named this specimen *Spongilla sinensis* as it was a new form. This is, so far as we know, the first scientific description of a new fresh-water sponge from China. This description was published in 1910 in the Proceedings of the U. S. National Museum, Volume 36. Additional materials were collected by the writer and sent direct to Dr. Annandale and later on, in 1915, after he had examined and published a description of some sponges taken from Lake Tali-fu in Yunnan by Mr. Coggin Brown, Dr. Annandale made a trip to China and Japan. During that trip he made some collections of sponges from Tai Hu (Great Lake) near Soochow. Since that time we have repeatedly sent collections of sponges made in and around Soochow to Dr. Annandale right on up to the time of his death in 1925. After the death of this enthusiastic sponge expert we could find no one who was in a position to carry on the study of this interesting group of animals in the Far East and as we were having to give up active teaching just about that time, we decided to begin the study of fresh-water sponges as a hobby during our spare hours or in the evenings when we were not occupied by routine work.

Few Specialists on Fresh-Water Sponges

We found that in order to make any headway at all in our study it was necessary to try to become familiar with what had already been done in this subject elsewhere. It seems that the present active workers on this group are very few and that large collections of fresh-water sponges are still fewer. This made it comparatively easy to get into touch with the few workers whose interests lie along this line and to get their aid and their advice. Every amateur should have the sympathetic counsel of at least one specialist in his chosen field. We have been very fortunate in finding two or three unusually helpful correspondents in Europe and America and be it said in their praise that their patience in dealing with details and their promptness in answering inquiries have been an inspiration to us in our efforts to learn something about the sponges. It is a pleasure to acknowledge their cordial help. They have also given us bits of authoritatively named sponges for comparison and have assisted us in securing the special literature on sponges without which a beginner cannot even start his work.

Comparative Materials

In order to begin systematic work satisfactorily one should have *type* or *co-type* specimens, or at least those named or checked by a well known specialist, of the described species of sponges in the genera in which he is working. It is difficult to get this material and we have spent much time during the last two years in trying to get specimens of the eight or nine species of the small genus *Trochospongilla* and even now we still lack one specimen to complete the collection of this small group. Where the number of known species in a genus runs into scores or hundreds, you can well imagine how nearly impossible it is to get a complete collection. The larger the collection of named comparative materials one has access to the more satisfactory will be his work in attempting to study his own local collections.

Literature

Failing to get the actual named specimens as a basis for his study the amateur should by all means have illustrated descriptions of as many of the species as possible. Illustrations often describe much better than words can. Here again one is at a serious disadvantage as many of the most needed descriptive works are now old and out of print. One's only recourse is to the booksellers who deal in rare, old and second hand books or reprints of scientific articles. The desired articles or reprints may be advertised for and possibly secured after quite a long time and they may prove costly on account of their rarity. Sometimes it is possible to get certain papers, that cannot be otherwise secured, photographed and this can be done at many of the large national libraries at a comparatively small cost. In fact with us it has proved cheaper in certain cases to have a photograph of a paper of several pages made than to buy the reprint. In certain libraries it is also possible to have typewritten copies of articles made at a fixed cost per page.

Local Collections

Having got together enough comparative materials and enough literature to begin work, there was the other difficulty of getting a representative collection of sponges from various parts of China. Here also we count ourselves unusually fortunate. We were able to collect very thoroughly for several years in the region around Soochow while teaching biology there and have had the good fortune of often collecting with wide awake students who are now widely scattered over the country and who kindly continue to collect for us. Quite a number of interesting materials have come to us in this way. Then too, we are privileged to make frequent extensive trips over certain portions of the country and have collected with the teachers of zoology in a number of places and they continue to send us materials from time to time. These men and other friends have been most helpful and through their continued kindnesses we have had specimens from Canton to Harbin along the coast and up the Yangtse River as far as Nanking. As yet we have had no sponges from the interior of China except bits of the specimens collected by Mr. Brown in Talifu which Dr. Annandale kindly sent us before his death. We would like very much to have sponge specimens from new localities, especially in the interior, as this would help to give us some idea of the distribution of the several known species over the country and to discover whether there were any additional new species to be found in China.

Known Species and their Distribution

In order to try to make available for workers on this group of animals, both in China and abroad, what has been done up to the present time on the sponges from China, we have brought together as much of this widely scattered literature as can be had on the subject and compiled from these various sources descriptions of the known species. In each case our descriptions have been accompanied by illustrations. These descriptions and illustrations have been carefully checked with the actual specimens where possible and we have added our observations where we have thought they would help to illuminate the matter. We are chiefly indebted to Dr. Annandale who has described most of the new forms, but we have added three new names, one species and two varieties. "*The China Journal of Science and Arts*" has published a number of these descriptions, one species at a time, during the past two years, so any one having access to the files of this periodical can find those descriptions which have already been printed. Some additional species are ready for publication in this Journal at a later date.

GENUS SPONGILLA

It is interesting that out of the ten species of *Spongilla* recorded from China, six of them are new to science and are not recorded from elsewhere. These six are marked with an asterisk. *Spongilla semispongilla* is known only from Japan and China. The list, with the distribution of each species in China so far as we now know it, is given below. Much of the country is as yet altogether untouched in this search for sponges.

GENUS SPONGILLA:

Sub-genus Euspongilla		
1.	*Spongilla lacustris*, auct.	Yunnan, Manchuria
* 2.	,, *micron*, Annandale	Kiangsu
3.	,, *semispongilla*, Annandale	Kiangsu
Sub-genus Eunapius		
* 4.	*Spongilla conifera*, Annandale	Kiangsu
* 5.	,, *geei*, Annandale	,,
6.	,, *fragilis*, Leidy	,,
* 7.	,, *carteri* var. *melli*, Arndt	Kwangtung, Fukien
Sub-genus Stratospongilla		
8.	*Spongilla clementis*, Annandale	Yunnan
* 9.	,, *sinensis*, Annandale	Kiangsu
*10.	,, *stanleyi*, ,,	,,

GENUS TROCHOSPONGILLA

Trochospongilla is a very small genus but the number of representatives of it here in China is quite remarkable. We have recorded five species and varieties of it from the lower Yangtse Valley in the two provices that have been most carefully studied up to the present time. Four, out of the five records, are new forms and three of them (those marked with the asterisks) are known only from China. The one numbered 15 below, *Trochospongilla tunghuensis*, is a new species which we have named from Chekiang Province and we have recently (November, 1926) found this same sponge also in Lake Biwa in Japan. This form resembles somewhat in the size and several characters of the spicules a form illustrated by Potts in 1881 in his "Monograph" on the fresh water sponges from America, but we can find no description of this and later writers seem not to recognize it as an established species.

Trochospongilla sol was found in Kiangsu by Dr. Annandale and the type specimen was the only one known until we had a small bit of sponge sent us in a bottle from Nanking but marked as having been collected in Fukien. This small bit contained a number of *Trochospongilla sol* spicules in it. A recent letter from a Fukien correspondent asserts that this bit was collected in Nanking. There is a doubt as to which Province it came from but it is a new locality in either case. Numbers 11 and 12 are very abundant.

We record below these five forms:

GENUS TROCHOSPONGILLA

11.	*Trochospongilla latouchiana*, Annandale	Kiangsu,	Chekiang
* *12.*	*Trochospongilla latouchiana var. sinensis*, Adle.	,,	,,
* *13.*	*Trochospongilla sol*, Annandale	,,	Fukien (?)
* *14.*	*Trochospongilla horrida* var. *ningpoensis*, Gee	Chekiang	
15.	*Trochospongilla tunghuensis*, Gee	,,	

GENUS EPHYDATIA

The genus *Ephydatia* more closely resembles both sponges than either of two genera already mentioned and some of our bulkiest sponges are representations of this group. Dr. Annandale reported both *Ephydatia meyeni* and *Ephydatia bogorensis* from the material which we sent to him from Soochow but we have failed to find it again though we have examined many specimens of this genus from Soochow and its environs as well as from Tsinan and Peking and have as yet not found either of these two species again. The one species of this genus that we find to be very common in the Yangtse Valley and in both Tsinan and Peking is *Ephydatia fluviatilis* and this species occurs in quite a number of different variations which are probably worthy of varietal names, but as yet we have given a varietal name to only one of these that is *Ephydatia fluviatilis* var. *chui*. Since the publication of our list of Chinese sponges in the "*Journal of the North China Branch of the Royal Asiatic Society*" (1926), we have been able to add another species of this genus to those already recorded—it is *Ephydatia japonica* from Manchuria. We also add a second name tentatively.

In going over some materials which came from Canton, we have found an interesting form of this genus which resembles somewhat the sponge described by Potts in America and Annandale in India as *Ephydatia (Meyenia) crateriformis.* More materials and a more careful comparison of this with others forms will be necessary before we would be in a position to make a final statement concerning this form. Only one out of this list of six records is new and confined to China.

We list the species below, marking the one species peculiar to China with an asterisk as we have done above.

GENUS EPHYDATIA

16.	*Ephydatia meyeni* (Carter)	Kiangsu
17.	*Ephydatia bogorensis*, Weber	,,
18.	*Ephydatia fluviatilis*, auct.	Kiangsu, Chekiang, Shantung, Chihli
* *19.*	*Ephydatia fluviatilis* var. *chui*, Gee	Chekiang
20.	*Ephydatia japonica* (Hilgendorf)	Manchuria
21.	*Ephydatia* near *crateriformis*, Potts (?)	Kwangtung

GENUS NUDOSPONGILLA

The genus *Nudospongilla* is represented by only one species in China so far and this one is found at Talifu in Yunnan Province. The gemmules are naked, or without spicules, and this accounts for the name. The gemmule spicules are rather suddenly pointed and are provided with spines covering most of their surface. The one species recorded is a new one and is found only in China.

GENUS NUDOSPONGILLA

* *22.*	*Nudospongilla coggini* (Annandale)	Yunnan

Work Still in Progress

This is simply a report of progress in our work on the sponges which we have in hand and which are coming to us from those interested in helping us get together a representative collection. Much remains to be done yet in carefully preparing slides from each specimen that we have and then comparing these with each other and with the slides made from material which has been named and sent us by foreign specialists. The whole study bristles with questions. Are all of the China species recorded up to date *good* species? In looking through a very large number of slides of spicules and then putting the sponges from which they came together, we feel that possibly some of our present *species* should be only *varieties* after all. For the present we will have to leave this point unsettled but in later years will come back to it with more material and larger knowledge, we hope.

Policy in Naming Forms

Some one has said "When in doubt about a form name it a new species, especially if it is from a new locality, and then the scientific world will look into the matter and confirm or disprove your statement. Name it a known species and it will never be noticed." We are not sympathetic with this idea because it creates many mistakes. Our policy is rather when we are in doubt about a form to submit it to two or more specialists, if two independently reach the same conclusion, it is pretty safe to accept that as final. If two disagree refer it to a third and accept tentatively the conclusion of the majority. We prefer to state our doubts where they exist rather than to make positive assertions about species still under consideration. We believe also that illustrations are far more descriptive in most cases than words and would urge that drawings or photographs always accompany the descriptions of new species or varieties of sponges.

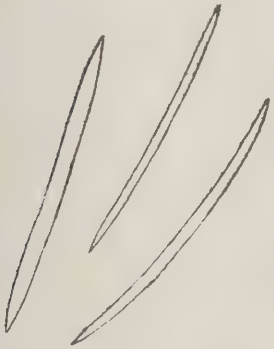

Fig. 1.
Skeleton spicules without spines.

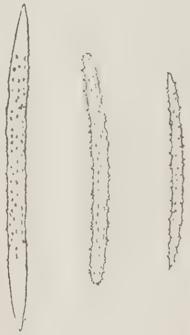

Fig. 2.
Skeleton spicules with spines.

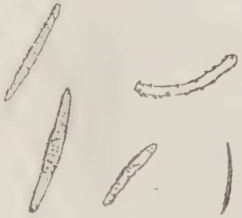

Fig. 3.
Gemmule spicules of the genus Spongilla type.

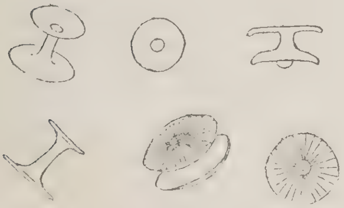

Fig. 4.
Genus *Trochospongilla*.
Gemmule spicules with smooth edges and of the type resembling a collar button.

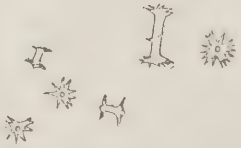

Fig. 5.
Genus *Ephydatia*
Gemmule spicules with incised edges.

FURTHER NOTE ON PERSIMMONS IN KWANGTUNG*

By F. A. Mc Clure

Agricultural Explorer, U. S. D. A., Assistant Professor of Botany,
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In a paper on persimmons in Kwangtung which appeared in a recent number of the Lingnaam Agricultural Review (Vol. 3, No. 2) the writer called attention to the fact that the persimmon, *Diospyros kaki* L., is said to occur spontaneously in northern Kwangtung. A fruiting branch oft his wild form was figured (Lingnan Herb. No. 12785, but the exact locality of its occurrence was not known. The writer has since had an opportunity to visit the region in question and was able to locate the source of the specimens seen and to confirm the fact that the plants are wild. Some fruits were found on the trees at Leng Pui (嶺背) near Yeung Uk (揚屋) in the immediate vicinity of Dragon Head Mountain. (Lung T'au Shan 龍頭山), as late as the fourteenth of January (1926). They are orange-red in color, round to slightly oblong in shape, and uniformly small, not exceeding 3.25 cm. in diameter. The point of attachment of the stem to the fruit is elevated and not depressed as it is in most cultivated varieties of *Diospyros kaki*. This is somewhat overemphasized in the illustration (Fig. 16) of this fruit in the above-mentioned paper, owing to the fact that the specimen used was a slightly immature one, dried as an herbarium specimen. The tree is said to attain a height of at least 7 meters where it is allowed to develop undisturbed, but most of the trees seen were small, rarely exceeding 4 m. in height, due to the periodic cutting over of the hillsides.

The question arises as to whether or not this may be an escape from cultivation. A number of points may be observed which seem to indicate clearly that the tree is native to this region. In the first place, it is rather common in this particular locality. In the second place, the fruits are uniformly small and seedy, and of a uniform shape, which would scarcely be the case were the trees to have come from the seeds of cultivated varieties. Further, persimmons are not cultivated in the immediate region in which the wild form was observed.

Another form, possibly a distinct species, was seen. Neither flowers nor fruits were available, but the persistent pubescence of the mature leaves, and the curious scaling off of large patches of the bark of the trunk, leaving light grey, sometimes almost white, areas, are characteristic.

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*Contribution from the Biological Laboratory.

A FURTHER NOTE ON A COMMON CHINESE WATER-STRIDER (Hemiptera, Gerridae)*

By William E. Hoffmann
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In Volume III, Number 1 (pp. 48-63, Oct., 1925) of the *Lingnaam Agricultural Review* the writer gave an account of the life history and biology of one of the common Chinese water-striders. At that time the identity of the gerrid was unknown to the writer but in the meantime it has been identified for him through the kind services of Mr. W. E. China as *Gerris paludum* Fabr.

The writer recently received typed copies of three references to this species. These are here reproduced for the convenience of those who do not have access to the original references.

Gerris paludum Fabr. 1794.

Joh. Christ. Fabricii. Entomologia Systematica, Tome IV, p.188, 1794:

> Niger subtus argentatus abdominis margine subferrugineo.
>
> Habitat in Galliae aquis stagnantibus.
>
> Affinis certe praecedenti at duplo fere major. Corpus totum supra striatum, nigrum, subtus, holofericeum, argenteum. Margo abdominis parum ferrugineus. Pedes quatuor postici elongati.

Douglas and Scott. The British Hemiptera, Vol. I, p. 559, gives the following:

> Above brown-black; beneath blueish-gray. silvery in certain aspects slightly shining. *Head* with a whitish line at the sides. *Antennae* black; 1st joint almost as long as all the others together. *Pronotum* slightly widened to the hinder angles, the sides there raised into a dwarf, obtuse tubercle; disk nearly flat, with a fine central raised line; scutellar process convex; the under-curved sides of the middle region yellow. *Elytra* brown-black; nerves black; *Connexivum* narrowly yellow-brown on the margin, the long terminal spines reaching rather beyond the genital segments, directed upwards, the sides projecting at the base, the points slightly convergent.
>
> *Head* long; sides with a whitish line; base with a short transverse yellow line going obliquely from the middle towards the middle of each eye. *Antennae* black; 1st joint almost as long as all the others together; 4th rather shorter than the 2nd. *Eyes* black, shining. *Ocelli* and *Rostrum* black.
>
> *Thorax.—Pronotum;* anterior region flat, with a short, yellow, longitudinal line in front; middle region slightly widened to the hinder angles, sides sharply defined, at the hinder angles raised into a dwarf, obtuse tubercle; the under-curved margins with a yellow line of equal width throughout; disk slightly convex, finely crenate punctate, obscured by the pile, and with a fine central raised line; scutellar process convex, the margins narrowly flattened. *Elytra* brown-black, as long as the abdomen (sometimes abbreviated); nerves black, at the base with yellow hairs. *Sternum: Prosternum* depressed, yellow, with a fuscous shade in the middle; *Mesosternum* in front, between the coxae, with a narrow longitudinal channel, which is widened and shallow posteriorly; on the side of the coxal sheaths a silvery line; sides

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*Contribution from the Biological Laboratory.

next the pronotum dull black, the colour divided into 2 lines by a silvery streak; sheath of the 2nd and 3rd pairs of coxae black above, pale yellowish beneath. *Legs*; 2nd pair slightly the longest; *coxae* black, the ends yellow-brown; *fulcra* yellow brown, blackish in the centre; *thighs* black above, gray-brown beneath; 1st pair slightly yellow at the base; 2nd pair shorter than the 3rd; *tibiae*; 2nd pair longer than the 3rd; *tarsi* 2nd pair, 1st joint 3 times longer than the 2nd; 3rd pair, 1st joint nearly twice as long as the 2nd.

Abdomen beneath, in the middle almost keeled, the sides of each segment, except the last, on the posterior margin, with a short silvery streak or spot; the posterior margin of the 6th segment in the ♂ with a somewhat right-angled excision; in the ♀ only slightly concave; *Connexivum* on the margin narrowly yellow-brown; the terminal spine black, directed obliquely upwards, subequal in thickness throughout, outwardly convex, inwardly concave, reaching rather beyond the genital segments in both sexes; in the ♀ a little curved outwards at the base, but converging at the apex, which is suddenly acute. *Genital segments* beneath ; in the ♂, the 1st with a tubercle; 2nd long, semioval; 3rd short, rounded; in the ♀, the 1st yellow-brown, subtrapezoidal, the base convex; the sides much compressed, hollow, with a subangulated prominence near each basal angle; 2nd black, semioval.

Length, 5¾—6½ lines.

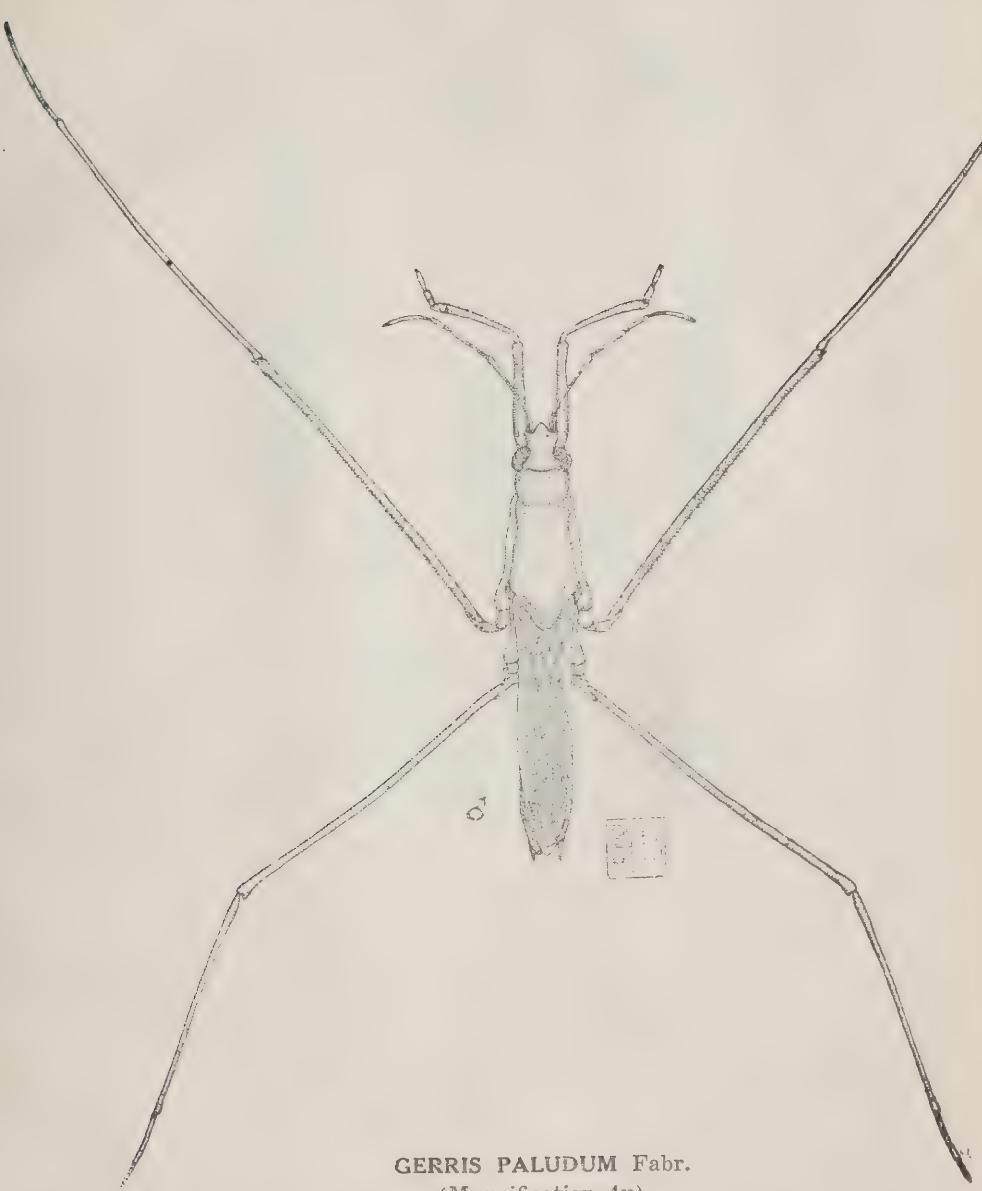
Distant, Fauna British India. Rhynchota, Vol.II, P. 180:

Black, opaque; body beneath silvery-grey, pubescent; base of rostrum, coxae, trochanters and extreme bases of femora very pale fulvous; pronotum with a strong central longitudinal carinate line; hemelytra with the veins very strong and prominent; legs fuscous; antennae with the basal joint very long, about as long as the other three joints taken together.

Length 12-13 millim.

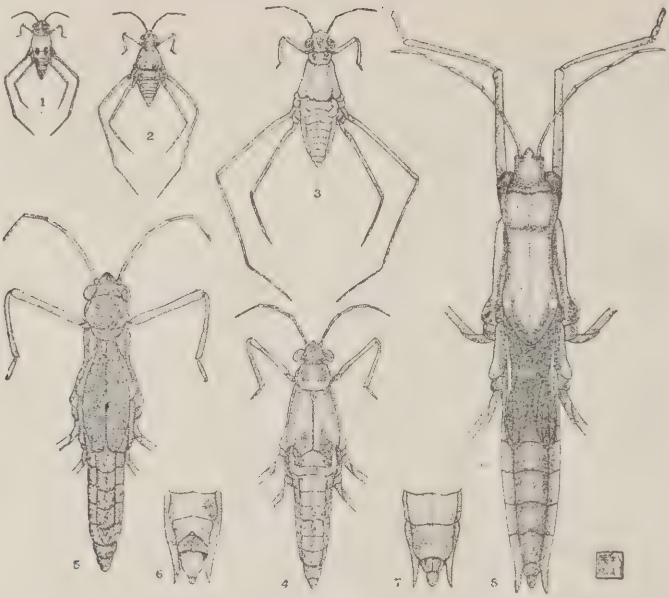
E.A. Butler in his "A Biology of The British Hemiptera-Heteroptera" pp. 246 & 247 (London 1923) discusses this species. In regard to the wings he says, "It is always fully winged, at least, in Britain; Puton says that examples have been found in France with the hemielytra extending only half-way down the abdomen." In China, as pointed our before, short-winged forms are commonly taken and sometimes all of the specimens collected at one time in a given habitat are brachypterous. Concerning distribution Mr. Butler says *G. paludum* is not so widely spread as *G. rufoscutellatus* Latr., although much commoner in Britain. "It occurs over Northern and Central Europe; it also passes into Turkestan and Siberia."

The writer has often witnessed an interesting performance staged by these gerrids and a common species of dragon fly. The dragon fly alights upon a stick or pole projecting a few inches out of the water while water-striders come from all directions and vie with each other for a position nearest the prospective victim. They drive one another away in order to better their own position and often leap into the air in an attempt to reach the dragon fly. Every few minutes the dragon fly leaves its perch, flies for a short distance (flying very low) and returns. As the dragon fly flies away the gerrids scatter, skating in the same direction; when it returns to its perch, they also return and the whole performance is repeated. It may be that the presence of great numbers of the gerrids annoys the dragon fly and that the periodic flights are an attempt to evade them; on the other hand it appears very much as though our aerial friend was having a bit of sport at their expense.



GERRIS PALUDUM Fabr.
(Magnification 4x)

Dorsal aspect of long-winged male; characteristic position when at rest upon the surface of the water.



GERRIS PALUDUM Fabr.
(Magnification 4x)

Figures 1-5—Instars one to five respectively.
Figure 6—Ventral aspect, tip of abdomen, ♂.
Figure 7—Ventral aspect, tip of abdomen, ♀.
Figure 8—Dorsal aspect of short-winged ♀.

CHARLES FULLER BAKER

CHARLES FULLER BAKER

(PORTRAIT, PLATE XVIII)

On the twenty-second of July the Orient lost a distinguished scientist and educator, Dean Charles Fuller Baker. His death was caused by chronic dysentery. He had been in poor health for several years. Funeral services were held July 24, one service in the morning at the College of Agriculture of the University of the Philippines at Los Banos, the other in the afternoon at the Union Church in Manila.

Dean Baker was born in Lansing Michigan on March 22, 1872. He was of English ancestry, the son of Major Joseph Stannard Baker and Alice Potter Baker, and the brother of Ray Stannard Baker, noted magazine writer and publicist. He received the degree of Bachelor of Science from the Michigan Agricultural College in 1892 and his Master of Arts degree from Stanford University in 1903. He was married in 1894 to Ninette Evans of Fort Collins, Colorado.

During the thirty-six years of his professional activity Dean Baker held the following positions:

1891-1892.	Laboratory Assistant in the Michigan Agricultural College.
1893.	In charge, Colorado Forestry and Zoology exhibit, Columbian Exposition.
1892-1897.	Laboratory Assistant in the Colorado Agricultural College, principally field control of pests and diseases.
1897-1899.	Biologist to the Alabama Polytechnic Institute and Experiment Station.
1899-1901.	Head Teacher of Biology, Central High School, St. Louis.
1903-1904.	Assistant Professor of Biology, Pomona College, California.
1904-1907.	Chief, Department of Botany, Estacion Agronomica de Cuba, in charge plant breeding, acclimatization, forestry—Investigations and Botanical Survey.
1907-1908.	Curator, Botanic Gardens and Herbarium, Museum Gaeldi, Para, Brazil.
1908.	Director-elect, Campo de Cultura Experimental Paraense.
1908-1912.	Associate Professor and Professor of biology, Pomona College, California.
1910.	Founder of Laguna Marine Laboratory, California (Summer Vacation Activity).

1912-1918.	Professor of Tropical Agronomy, College of Agriculture, University of the Philippines.
1917.	Assistant Director, Botanic Gardens, Singapore (Vicarius war Service). (Appointed Dean, College of Agriculture, University of the Philippines, September 27, 1917).
1918-1919.	Acting Dean and Professor of Tropical Agriculture, University of the Philippines (did not accept Dean-ship when first offered).
1919-1927.	Dean and Professor of Tropical Agriculture, College of Agriculture, University of the Philippines.

During his residence in the Philippines Dean Baker served in the following subsidiary, advisory, and consultory capacities:

Special Agent, Bureau of Non-Christian Tribes.
Technical Assistant to the Director of the Bureau of Agriculture.
Tobacco Inspector, Bureau of Internal Revenue.
Associate Editor, Philippine Journal of Science.
Associate Editor, Philippine Agriculturist.
Associate Editor, Philippine Agricultural Review.
Cooperator, United States Department of Agriculture.

Dean Baker conducted or took part in many field expeditions and surveys, largely through private enterprise. In 1897-8 he accompanied the H. H. Smith Exploring Expedition into the mountains of Colombia as the botanist of the party. He had also been on expeditions to Cuba, Nicaragua, Brazil and Malaya, as well as the main islands of the Philippine group. In the United States he had conducted field explorations in southern Illinois, Wisconsin, Colorado, New Mexico, Nevada, and California.

The most important work of a survey nature was his *Malayan Entomological and Mycological Survey*, consisting of comprehensive field work carried on during the decade and a half that he lived in the Orient. This work was carried on in all the larger islands of the Philippines and extended to North Borneo, Singapore, and Penang. Dean Baker had secured the effective cooperation of 115 of the best specialists in the world to work up the several taxonomic groups.

Over 400 important scientific papers have already been contributed by these workers and many others are in preparation. Contributions based on the materials collected by Dean Baker will be coming out at a steady rate for many years to come. Many hundreds of thousands of specimens have been collected, sorted, and shipped to specialists, all at personal expense and on extra-official time.

Dean Baker made many direct contributions to museum development. Some of those known to the writer are as follows:

1. In 1899 he presented to the United States National Museum a collection of American Hemiptera and Hymenoptera, including some 60,000 specimens.
2. In 1912 he presented to Pomona College a collection of American insects, including some 75,000 specimens and a herbarium of about 200,000 sheets, as well as a considerable biological library.
3. In 1921 he made a gift to the department of pathology of the College of Agriculture of the University of the Philippines of a collection of Malayan Fungi of some 15,000 specimens.
4. In 1922 he gave to the department of botany, College of Agriculture, University of the Philippines, an herbarium of Malayan plants of about 5,000 sheets.
5. Numerous lesser contributions to many institutions including a donation of Coleoptera of Para to the Hamburg Museum.

In addition to these collections, oriental material (mycological and entomological) has been placed in the hands of the hundred and more specialists to the extent of several hundred thousand specimens, while the specimens in the present *Baker Collection* probably run well above a quarter million in number.

A very significant fact about this great oriental collection is that it has been made and cared for exclusively by private enterprise and the consistent utilization of extra-official time and opportunity. The creed of the late dean according to a colleague was that gigantic tasks may be accomplished by the utilization of odd moments.

According to the terms of the will of the late dean, drawn up several years ago, his entire collection of insects (1,459 boxes), his manuscripts and indices, and his correspondence are to go to the Smithsonian Institution, which institution agreed to send out a man from America to properly pack and ship the collection. Characteristic of the dean's foresight and thoroughness a special sealed envelope, containing instructions to the packer, was left among his effects.

The miscellaneous collections such as mollusca, fungi, etc., according to the will are to go to the College of Agriculture of the University of the Philippines as does also his biological library. His collecting paraphenalia and work instruments and also alcoholic specimens are to go to Dr. L. B. Uichanco of the department of entomology of the College of Agriculture, University of the Philippines.

A very important part of the dean's collection is his *Bibliography of Indo-Malayan Entomology*, which consists of two large stacks of manuscript and 35 trays of 3 by 5 cards. These cards probably number somewhere in the neighborhood of 100,000, each card bearing from one to three entries in his own handwriting.

Dean Baker's very high standing in the museum world is attested by the fact that when several years ago he decided to leave the Philippines because of poor health he sent a circular letter to several individuals and institutions in which he stated that he was in a position to consider a position in a less enervating climate, and as a result of this letter several attractive positions were offered to him. In this connection it is of interest to relate a recommendation which was once given concerning Dean Baker. It said, "If you have an impossible position in an impossible place, get Baker."

The Philippines would soon have lost Dean Baker, temporarily at least, even if his untimely death had not occurred for he had tendered his resignation, effective November 30, 1927. At this time he was to have become Dean Emeritus, and Director Emeritus of the College Experiment Station, according to action taken by the Board of Regents of the University.

The new position to which Dean Baker was called was that of scientific head of an *Entomological Survey of the Pacific*, a project planned by a group in Hawaii (See *Science* for June 10, 1927) and supported in part by the Bishop Museum and the Hawaiian Sugar Planters Association.

Dean Baker (before being appointed dean he was always known as "Dr. Baker") was very much loved in the Philippines where he was one of the builders of the College of Agriculture of the University of the Philippines, a beautiful and efficient plant developed from a jungle during the short period from 1909.

The high esteem in which Docter Baker was held was everywhere voiced. We quote below a few of the many statements made.

Acting President Jorge Bocobo of the University of the Philippines said:

> I feel a deep sense of personal loss over the death of Dean Charles F. Baker who was a very dear friend of mine. These many years I have admired his high ideals of service, his enthusiasm for scientific research. He was one of the founders of the Agricultural College at Los Banos, facing all manner of difficulties attendant upon his pioneering tasks. For fifteen years he devoted his utmost to the growth of the college whose standards he and his co-workers have greatly elevated.

His death is an irreparable loss to the University of the Philippines, to scientific agriculture in the Islands, and to science in general. His researches on botany, entomology, and tropical agriculture are known all over the world. His faculty and students at Los Banos loved him, for he always inspired them to give of their best to their allotted work.

Dr. William H. Brown, Director of the Bureau of Science, said:

Dean Baker meant much to the Philippine Islands. Money could not have hired a man to do the work he has done, and which he did for pleasure. I understand that he worked consistently every night on his collections after he had worked all day at the agricultural college. Men of his caliber are always better known [and better appreciated] in other parts of the world than they are at home.

Professor Emma S. Yule, head of the Department of English at the College of Agriculture, spoke of Docter Baker as a man of many facets and said, "There is no one like the Dean." She said:

Dean Baker was the most inspiring force I have ever known. It was, indeed, a sluggish lump which he could not fire with a zeal to do-or to make an effort, at least. This force plus his own unparalleled energy and industry directed by unusual mentality made him a tremendous power in achievement as an educator, a citizen, as well as in his special field. Life had hit Dean Baker hard at times, bodily pain had long been his constant companion, yet his friends and colleagues will always see his gay and humorous smile, hear his spontaneous laugh. He met life with so gallant a spirit. 'Such a man might be a copy to these younger times.'

Dean Baker belonged to the following scientific associations and societies: American Association for the Advancement of Science (fellow), American Association of Economic Entomologists, Entomological Society of America, Entomological Society of Washington, New York Entomological Society, Southern California Academy of Sciences, Hawaiian Academy of Sciences, Linnean Society, Lyon, Entomological Society of France, Entomological Society of Italy, Deutsche Entomologische Gesellschaft, Entomogical Society of Belgium. He was listed in *American Men of Science* and *Who's Who in America*.

Dean Baker was very active in the field of scientific publication. He edited "Invertebrata Pacifica," First Report Laguna Marine Laboratory, Exsiccati of West American Plants (through many years), Fungi Malayana (Exsiccati), Pomona Journal Economic Entomology, Pomona Journal Economic Botany, served as Associate Editor of The Philippine Journal of Science, The Philippine Agricultural Review, and the Philippine Agriculturist. He was author of many papers on botanical, entomological and tropical agricultural subjects and we hope to include a list of them in a later issue.

In the field of taxonomy Dean Baker specialized in the following groups: Braconidae (part), Cercopoidea (part), Machaerotidae, Jassoidea, Fulgoridae s. str., Lophopidae, Issidae, Tettigometridae, and Trophiduchidae.

Dean Baker always lived simply and for many years before his death he lived in a *Swali* house in which was his personal laboratory and storage rooms for his collections. For the last eight years he gave half of his salary to fellow-scientists in Europe who had been reduced to poverty as a result of the war. His whole career was one of loyalty to his work and service to mankind. While his contributions to science through scientific research are well known his ability as a teacher was of no less importance. It is said of him that he often took students who were thought incapable of learning and made of them worthy scholars.

At the funeral services, the memmorial service, in the press and in conversations only the highest tributes were paid to the late dean. "Dean Charles F. Baker was one of the best gifts of America to the Philippines" said Rev. Orwyn E. Cook in the funeral address in which he characterized the dean as a scientist who poured out his being in sacrifice for the advancement of science and a man possessed of a brilliant mind and a great soul. In expressing regret that Dean Baker should die when he hardly had passed middle age, Reverend Cook called attention to the fact that he put as much into every day as most persons put into two, and in fact accomplished far more in a relatively short life than most persons accomplish in a much longer one. It might be pointed out in this connection that Dean Baker had not been out of the tropics for fifteen years and had taken no real vacation during that period. His vacation leave from College was spent in arduous investigational trips in the Philippines for the College or for the Philippine Government in connection with Agriculture, or in intensified work in his own laboratory. His life was "Without haste, but without rest."

William E. Hoffmann.

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As previously announced the *Lingnaam Agricultural Review* will be issued as a quarterly beginning with the fifth volume. The name will be changed to *Lingnan Science Journal* and the size changed to 6 by 9 inches.

Inasmuch as indices were not issued for volumes 1 and 2 they have been prepared at this time. In these indices, as in the case of the index for volume 3, generic and specific names occurring in lists and enumerations are omitted. In the index for volume 4, however, all generic and specific names are included. Title pages for all four volumes have been included. Subscribers who are planning to combine several volumes when binding should bear in mind the above-mentioned change in size.—Ed.

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